THE

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SPEED-REDUCTION GEARING IN SHIP PROPULSION.

THE marine engineering world is considerably perturbed by the many unsatisfactory reports which have been received regarding the working of the mechanical speed-reduction gearing installed on turbine-propelled vessels. In order to obtain a high propulsive efficiency in a screw steamer, it is necessary that the speed of rotation of the screw should be low; at the same time, a turbine having a high speed of rotation must be employed in order to obtain the maximum economy in steam consumption. Further, a high-speed turbine is considerably smaller as regards both weight and space occupied than is a turbine having a low speed of rotation, and this, obviously, is of great importance on board ship. Hence, it has become almost universal practice on turbine-propelled vessels to fit helical gearing, so that a high-speed turbine can drive the propeller at its most economical speed. A pinion is mounted on an extension of the turbine shaft, and this pinion drives a gear wheel mounted on the propeller shaft, thus giving a "single-reduction" gear. This type of gearing has been found to answer very satisfactorily, and speed-reduction ratios exceeding 20 to 1 have been successfully obtained by this method.

The desire for even greater speed-reduction ratios enabling turbines running at a speed of 4,000 revolutions per minute or more to be employed to drive propellers running at 75 revolutions per minute led to the introduction of "double-reduction" gears, in which the first gear wheel shaft carries a second pinion, this in turn driving a gear wheel mounted on the propeller shaft. Many such gears have been fitted, particularly on cargo steamers, and it is this type of gear which is proving so unreliable in practice.

Many cases are on record of vessels fitted with double-reduction gearing in which, even during their trial trips, an undue amount of vibration and noise has developed in the gearing. If no further trouble has developed, the vessels have been accepted by the owners and put into regular service, because it has become almost an accepted fact that a certain amount of noise is inseparable from the use of gears of this type. Often enough the noise has been excessive, and the vessel has earned the unenviable distinction of being "a roarer." Frequently the noise has tended to diminish after a while as the wheel teeth become worn together, the hard steel of the pinion grinding away some of the inequalities of the teeth on the softer material of the gear wheel. In many cases, however, the trouble has tended to increase until finally the gears have failed altogether, due to excessive wear, or the chief engineer has been compelled to run the machinery at reduced speed until a port was reached where examination and repairs could be effected in order to avoid a risk of immediate breakdown.

So serious has the position become that the *Liverpool Journal of Commerce*, a journal which expresses the opinions of a large number of influential shipowners, in referring to this question, states that "the recurring troubles with marine turbine gearing, especially with double gears, have reached that critical stage when something must be done, and done quickly." We understand that the Institution of Mechanical Engineers has invited manufacturers and users of these gears to meet and discuss the question, but so far, except for individual efforts, little appears to have been done to get to the root of the trouble.

Notable contributions to the literature of the subject were two papers which were read at the annual meeting

of the Institution of Naval Architects in London last spring. Mr. J. W. Wilkie, in his paper entitled "Double-reduction Gears in the s.s. *Melmore Head*," gave a very full account of the defects which, right from the first trial, developed in the gears fitted on that vessel and of the subsequent steps which were taken to surmount the trouble; while Dr. J. H. Smith, in his paper entitled "Nodal Arrangements of Geared Drives," gave a complete mathematical investigation of the periodic vibrations of the various parts of the original gearing, and showed how by certain modifications he was able to eliminate to a large extent the vibration and the excessive noise and wear which vibration entailed. The subsequent discussion of these papers, however, showed that many designers were far from accepting the conclusions arrived at by Dr. Smith; while it was generally admitted that the accepted theories of the transmission of power by means of helical gearing appeared to fail when applied to double gears, it was felt that by sturdier construction and the use of materials of a higher quality, satisfactory and reliable gearing could be produced. But so long as the causes which produce failure are not removed, complete reliability cannot be obtained, and the advantages of the turbine drive due to the reduction of weight and space are to a large extent neutralised.

The failure of mechanical gearing undoubtedly presents a most favourable opportunity for manufacturers of electrical machinery to demonstrate that the electrical system of speed reduction—or electrical propulsion, to give it another name—is capable of proving a reliable and efficient method of operating cargo ships. Broadly speaking, what is required is an alternating-current generator driven by an efficient high-speed turbine, and a low-speed motor direct coupled to the propeller shaft and driven directly by the current produced from the turbo-generator. The machinery must be simple and fool-proof, and it must compare favourably as regards initial cost, weight, and space occupied with the present arrangements of turbines and double-reduction gears. If this machinery is forthcoming, we do not doubt but that the other advantages which would follow the adoption of electrical propulsion, which were recently set forth in our columns by Mr. A. Regnauld,* would lead shipowners to consider favourably the electrical gear as an alternative to the unreliable mechanical gear.

THE WELL-BEING OF EMPLOYÉS.

The third annual Industrial Welfare Conference has just been held at Balliol College, Oxford. It was organised by the Industrial Welfare Society, and extended from Saturday last until Tuesday. The proceedings are of considerable interest to all who believe in industry being made as humane an affair as is practicable. It is generally recognised to-day that there are obligations resting upon the employer to make the conditions of factory life as healthy and congenial as possible, as well as obligations resting upon the employé to co-operate with the employer in the conduct of measures designed to that end. A recognition of a duty, however, is not always and everywhere followed by a conscientious fulfilment thereof, but it is satisfactory to note that the industrial welfare movement has made great progress during the past few years, and it is to be hoped that further headway will be made with the application of various methods of rendering the hours of toil less monotonous, nerve-wracking, irksome, and dangerous, and with the provision of reasonable social facilities for brightening the after-work hours. The use of the word "welfare" has sometimes been objected to as savouring of coddling, which British workers, with their natural spirit of self-confidence, rightly resent, and we can imagine that the promotion of efficiency by the encouragement of the "Suggestion Box" system would be regarded as hardly a matter of "welfare" as it has come to be understood. One of the Oxford lecturers directed attention to this subject which, of course, has been with us for scores of years. He mentioned that there are large numbers of firms who offer prizes to their employés for suggestions conducing to the efficiency of the business, but he emphasised the need for doing everything in reason to encourage larger numbers of employés to take a sustained interest in such schemes. He advocated the widening of the range of subjects and the ample rewarding of those who advanced even what appeared to be trifling ideas; also prompt consideration of suggestions and full publicity. We have long favoured such schemes in the Electrical Review, but we are not prepared to say whether the author is altogether correct in blaming the management where the box intended for suggestions contains nothing but cigarette ends. It was felt that more satisfactory results would attend such efforts if an outline were circulated of subjects suitable for suggestions—perhaps for the manufacturing class or alternatively for the general—as well as a list of the minimum awards paid for different classes of improvements. The question or suggestion box idea should be welcomed by managers and by directors as a means of stimulating the interest of the worker in the success of the business or industry of which he forms a unit, and when seriously treated by all parties it should tend to the increased efficiency and prosperity of that business and the well-being of all. The Suggestion Box is assuredly a good business proposition.

Another of the Oxford lecturers added one more powerful appeal to the many thousands that have gone forth in recent years for co-operation and goodwill in industry. Whitley councils and works committees; the need for statesmanship amongst those concerned with industrial relationships (both in their wider national aspects and in individual firms) were discussed, and many other matters were reviewed which are supposed to be aiding the spread of a "new spirit" in industry.

The importance of keeping records and statistics was dealt with in an address by Dr. H. M. Vernon, of the Industrial Fatigue Research Board. He stated that a system of efficient records and statistics is an integral part of the new ideas of industrial management which are steadily gaining ground. The elimination of waste in industrial establishments was mentioned as a means of betterment which must prove eventually of benefit to all concerned, and it is only possible if the requisite records are kept. Records should be kept of lost time due to ill-health as distinct from other and avoidable causes; also of lost time due to accidents and injuries incurred, and of the type of machine or operation on which such mishaps occurred; the effect of fatigue due to overtime; the loss effect where new workers are being trained, and so on. The need for accident prevention campaigns amongst workers, and such matters as temperature and ventilation of workshops also came within the scope of Dr. Vernon's address. Much information on these and allied subjects has been given in the reports of H.M. Inspectors of Factories and Workshops. There are fairly reasonable standards recognised in the best factories and works in regard to many of the matters affecting the health and well-being (or welfare) of employés, and it has to be recognised, too, that we were all so over-done with forms for records and statistics during the weary years of war that all our eagerness for increasing the humane element in factory operation leaves practically untouched the prejudice that exists against any additional record and statistical burdens.

We have great respect for the views advanced by Mrs. Carney, lecturer on Industrial Welfare at the Manchester College of Technology, on "Health, First Aid, and Safety," and we agree with her when she says that employers have a great responsibility with regard to the health of their workers, but anybody who has studied the reports of the Government Inspectors of Factories and has observed in practice the carelessness, callous-

* Elec. Rev., August 4th, p. 171.

ness, and apathy of some workers in taking care of their own health and guarding themselves against accident and disease by availing themselves of the means placed at their command, will know that responsibility is not limited to employers. Mrs. Carney apparently recognises this when she refers to the educational aim that should characterise industrial health service.

There is little need to refer here to the value of the industrial canteen to works employés. Hundreds of electrical and engineering works, large and small, have proved it in recent years. There are now over 2,000 firms having organised canteens, and we gather that the canteen is now included as a matter of course in new works' schemes, and that in practically every trade, employers are carefully considering the advisability of the introduction of such accommodation. That it plays an important part in any works organisation scheme is unquestionable. According to Mr. A. F. Agar, formerly chief organising inspector of munitions canteens, these departments result in better time-keeping, less sickness, more time for recreation, and have an influence on the workers' homes. One speaker at Oxford referred to the canteen's usefulness in dissipating grievances quickly when men discussed them together over a decent meal. We should prefer to tread cautiously on this ground.

One other matter that was brought forward was the superannuation of the worker. It seems from the inquiries received by the Industrial Welfare Society from all parts of the world that no question connected with industrial welfare is receiving greater attention. The feeling of insecurity with regard to the future haunts large numbers of workers who out of their wages cannot possibly make adequate provision for old age, and to find means for relieving that anxiety is a purpose worthy of the efforts of all legislators and social reformers, associations and unions, and all who have the welfare of our industrial race at heart.

Scientific and Industrial Research.

The report of the Research Department for the past year, which was recently issued, places the necessity for economy in the forefront; pointing out that "in happier circumstances, the Department would by now have been able to take full advantage of the increasing opportunities for useful research," it declares that this is for the moment impossible. Apart from grants to research associations from the "million fund," the expenditure last year was £338,552. The policy of retrenchment has involved a slowing-down of the research programme, but has not interrupted good work already in hand, and while we recognise—and deplore—the imperative need for economy, we are glad to note that the Committee on National Expenditure was unable to find any evidence of extravagance or waste and made no recommendation for further reductions.

The balance of the million fund on March 31st, 1922, was £816,850; that the interest (£65,359) on the balance was greater than in the previous year, in spite of the reduction in the capital, was due to the re-investment of the fund in other Government securities, a fact which does credit to the management of the fund. The total expenditure for the year was £525,585, of which £273,194 was contributed by the Exchequer, and £100,678 was derived from fees for tests and special investigations; headquarters administration cost £37,561, or 7.15 per cent. of the expenditure.

In the report a number of instances are quoted in which the value of researches effected with the aid of the department has been demonstrated on a commercial basis. A Portland cement manufacturer, whilst acknowledging the merits of the mechanical appliances designed by the Research Association, remarks that "compared with the work the Association has done in furthering what may be termed 'scientific management' in the cement trade, they are a small matter. The value of the spirit of accuracy and the spread of the knowledge of how science can be applied is of tremendous value to the trade, and leads firms to further investigations and improvements. We are now saving fuel to the value of over £25,000 per annum." No better testimony to the fruitfulness of research could be desired; it is as though the works' organism had been inoculated with a serum the beneficial effects of which spread throughout it, infusing health and vigour into all its members. Remarkable results have been gained by the British Scientific Instrument Research Association in connection with improved abrasives and polishing powders, and other instances of successful investigations are recorded.

Whether scientific research is receiving a fair share of the department's attention seems open to question. The expenditure on grants for this purpose during the academic year 1921-22 was estimated at £47,005, or less than 9 per cent. of the total outlay. The great bulk of the report—and of the expenditure—is devoted to industrial research, and whilst we recognise the importance of this work, we regret that the department shows no enthusiasm for the promotion of the more fundamental investigations which are essential to the future prosperity of our industries.

The Tramway Problem.

In his presidential address before the Municipal Tramways Association last week, Alderman Mayne ably stated the case for the tramways in the increasingly strenuous struggle between them and other modes of transit, which is likely to engage the attention of Parliament in the near future. The inequity of the burdens which are laid upon electric tramway undertakings, in contrast with the demands upon the automobile vehicles which compete with them, has long cried out for rectification. As the president remarked, "On equal terms they can outstrip with ease all their rivals and competitors"—but they have never enjoyed equal terms, and the advocates of rival systems, in basing their comparisons on the existing conditions, close their eyes to the handicap which the tramways carry.

Alderman Mayne, spurred on by the proposal of the Underground Railways that they should be granted ten years' immunity from omnibus competition, did not hesitate to claim that the municipal tramways had a still better right to a monopoly. We would not go so far as that; equitable conditions would suffice to enable the tramways to prove that they could give an efficient all-weather and all-day service at the lowest cost. But his contention that the proposal of the Underground Railways implicitly involved subsidised omnibus competition with the municipal tramways was well founded, for the London omnibuses are almost wholly controlled by the Railway group, and any deficit on the former is made good by the latter.

Mr. Mattinson's paper on the same subject was a moderate summary of the position; he recognised that the tramways must bear their due share of the cost of road construction and maintenance. But he made it clear that under present conditions they were charged with heavy liabilities for which they should not be held responsible, while the president set forth in full the other statutory burdens from which competing systems are wholly free, and there is no doubt that the tramway undertakers have a very strong case for the reform of the law on this subject.

The Gennevilliers Visit.

On Friday, September 15th, we forwarded application forms and full details as to routes and expenses to all who have indicated to us their desire to participate in the visit to Gennevilliers and the Northern stations.

No time should be lost in filling up and returning the forms, particularly in those cases where passports for France and Belgium are required.

D

FRANCE REVISITED.—II.

Impressions and Comparisons.

By THEODORE RICH.

Seasonal Water Power.

France is, and has been, mainly an agricultural country, although during the war it very distinctly found itself as a manufacturing nation. The Frenchman is very adaptable, and in many districts the water-power supply fits in to the seasons when there is the least agricultural demand. Many men who work in electrochemical works during certain months of the year can be found in the harvest field at other times. It can be quite well understood that the more adaptable people are, the less distress there is in hard times; although even in France the trade unions are trying to pen the workers up in watertight compartments, it seems that workers there prefer work to the "spongers' dole." There is one difficulty—the greater the "demands" of the worker the greater the demand for machinery, and therefore the greater the capital outlay per employé; this tends to make seasonal water supply a difficult problem. With interconnection the matter becomes easier, the very high overload capacity of modern steam plant distinctly easing the situation.

Electrical Power Lines.

As previously stated, a large number of power lines have been erected or are under construction. As a rule, especially in the north, the new main trunk lines, 45,000 volts and upwards, are cross country, while those of lower voltage are more often alongside the roads—by-roads, provided they are reasonably straight, being preferred. In the devastated areas, in order to get over wayleave difficulties, use has been made of the special facilities and regulations made by the Government. Although there has been a large increase in the use of reinforced concrete poles, it has been found that, owing to transport difficulties, they are more convenient for roadside than for cross-country lines. The fall in the cost of structural steel has recently rendered reinforced concrete posts less attractive, although a number of attractive bridges were seen under construction made of this material.

There seems to be a tendency to increase the spans; a number of 45,000-volt lines with 160-metre spans were seen, some of the newer lines being 6-conductor, two-circuit. As in America, there still seems to be a controversy regarding the use of an earth wire or earthed insulator stalks with wood poles, though, of course, in the United Kingdom, where we have the least experience, the matter has been settled. There is still in some parts, especially in the north, a controversy regarding the merits of glass or porcelain insulators for high-pressure work.

The advocates of porcelain say that the use of glass involves a continuous loss, while advocates of glass say that the latter stands up better in wet, windy areas like those of Flanders and Picardy. Up to 45,000 volts there seems to be no material increase in the use of chain insulators; in fact, in the Béthune area, in order to be in a position to utilise an existing 45,000-volt line and not get the conductors too close to the ground, experiments are being made with a view to using stalk insulators, made of glass, at 100,000 volts. The use of 15,000 volts for general distribution is distinctly spreading in the north, it is not too expensive where cable has to be used, and in areas where the climate is similar to that in England it has proved in every way suitable for rural and outer-suburban overhead distribution to outdoor or cabin transformer stations.

As, according to law, the local authorities can charge a small rent per square metre for space taken up on the pathway or roadway, great ingenuity is sometimes shown in compressing the apparatus into a small area, the use of two storeys at the transformer post making the connection to overhead lines, without the danger and nuisance of a short length of cable, a matter of no difficulty.

Rural Lines.

Although village and rural distribution has not perhaps reached the degree found in some parts of the United States, yet light and power are to be found in an astonishing number of small places; such distribution is usually made with simple apparatus and a wooden pole line (fig. 1). It is quite usual when going along a village street to hear the hum of a motor and the click of a belt joint. In an area between Béthune, St. Omer, and Abbeville, in order to encourage rural development, some single-phase 15,000-volt branches are

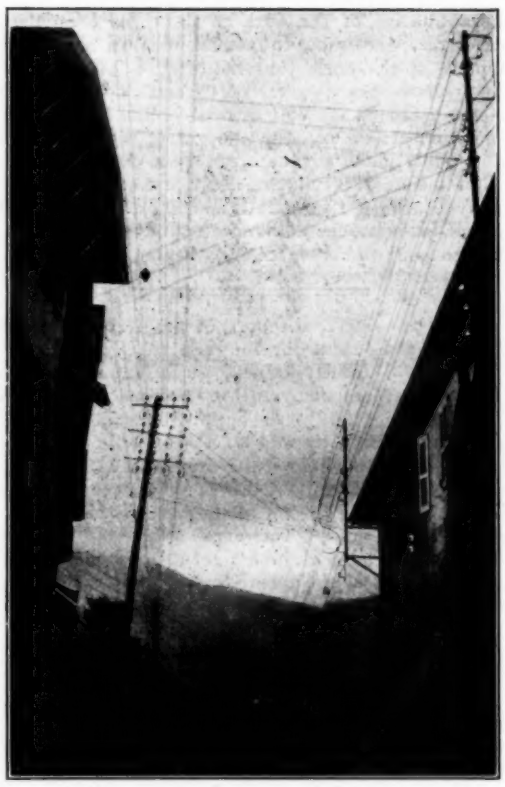


Fig. 1.—H.p. Line Passing over Roofs of Houses in a Small Town in French Savoy. The l.p. Distribution Line can be Seen Below the h.p. (on the Right), with Connections to Houses across the Street.

being tapped on to three-phase mains with single-phase, 3-wire, 120-volt distribution. In order to obviate a change of system, in cases where motive power is wanted, a three-phase motor with slip rings is used across the 220-volt outers; the third phase is connected on starting to a point with a resistance on one side and a reactance on the other. Some of these branches are made with iron wire. When the load grows, a three-phase copper line will be run, and the three-phase motors already installed will then be used for full power and not merely for 0.6 of the output as with a single-phase connection. It might be remembered that at a number of base camps and depôts at Le Havre during the war, single-phase three-wire outdoor transformers were installed by the R.E., and a start was also made in the Béthune area

with transformers on 15,000 volts. At the present price of copper, unless the voltage is about 15,000, there seems to be little advantage in the use of iron wire, although galvanised iron wire should be cheap enough in the north of France. In many of the lines in France local timber is used, and in Spain, in the Pyrenees, all sorts of crooked poles seem to be usable to enable the conductors to be kept off the ground. It is amusing to note that a few months ago an English railway journal made quite a "song and dance" about the fact that the Great Western Railway, with a technical temerity almost worthy of a Stephenson or Brunel, in Cornwall, for a light railway, had actually used some local timber to support the telegraph lines for the railway working; it is to be hoped, however, that the railway experts at Whitehall will not get the wind of such a departure from virtue.

According to French law, a power company can obtain a wayleave along a road either for cables or overhead lines for a small sum per post or per kilometre, the price depending on the density of the population, so that where there is an alternative route it is naturally easier to treat with land owners. There is also the point that probably 60 per cent. of the roads in France are without hedges; this makes the running of roadside lines much easier.

Before the war, as in England, in those parts where the finance of power companies was to a great degree in the hands of cable-making interests, the use of overhead lines was to a material extent restricted, although in France financial necessities, especially in the devastated areas, have made even cable enthusiasts pause.

After the war the French Government put up a number of interconnecting trunk lines, and in order to encourage home industry and minimise exchange difficulties stranded conductors of aluminium were largely used. Owing, it is said, to impurities in the composition, and perhaps also to lack of experience in its use, there seems to be in some quarters a distinct bias against its use, especially in the North. In France, although up-to-date methods are usual with regard to the design of overhead lines, the apparatus and methods employed for erection and repair, as, for instance, the repair of live circuits, do not seem to be as up-to-date as in the United States, although there seems to be an absence of the "bulletin" inspiration, which is often a feature across the Atlantic.

Lightning Arresting Apparatus.

It is remarkable, especially in the north of France, how much of the lightning-protection apparatus is out of use. Electrical discharges are perhaps not so frequent in rolling country as in mountainous districts like the Pyrenees or the Alps. Choking coils, a solidly-constructed line, and as far as possible a transformer between the overhead line and the generators, seem to be looked upon as good safeguards.

Before the war, horn arresters with water resistances were very common, glycerine being used to prevent freezing. Glycerine became unobtainable, so people began to empty the resistances in winter, and forgot to fill them or left them disconnected during the following summer and, strange to say, little harm resulted. What is suitable in some areas is of little use in others. In some parts an earth wire has been found to be necessary; in other parts it has been said that the earth wire breaks more often than the copper line it is supposed to protect.

Central-station Plant.

Before the war, two systems were somewhat fashionable with regard to condensing, the Le Blanc rotary air pump and the German system with a horizontal low-speed dry-air pump; nowadays the ejector air pump, especially the Breguet system, seems to be extending. To obviate the objection of putting too many eggs into one basket, steam turbine-driven auxiliaries seem to be more popular than electrical auxiliaries, especially for circulating and condenser hot-well pumps, the exhaust being put usually into a low stage of the turbine. In France, as on the Continent generally, engine-rooms and boiler-houses seem to be more spacious than in England, and perhaps, if anything, the pipe systems are less complicated.

French boiler makers appear to have grasped, what it took the Anglo-American boiler combine so long to learn, that for efficient combustion one must leave ample space before the gases are cooled by contact with the water tubes. The disposal of ash and clinker seems to be still a matter of difficulty, some engineers saying, after somewhat excessive repairs have been paid for, that a tipping truck worked by hand filled from a shoot takes a lot of beating.

Fig. 2.—Houses for Operatives at the Soulom Power Station of the Midi Railway in the Pyrenees.

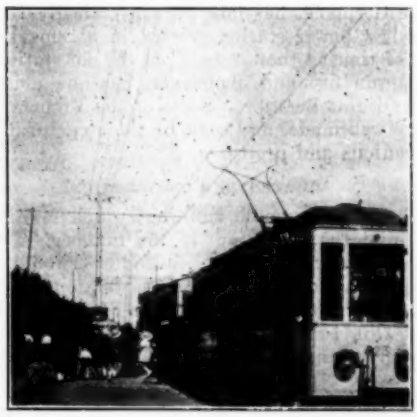


Fig. 3.—Catenary Construction on Railway.

All over the north of France the system of chimneys made up of sectional concrete with a vertical rib and internal reinforcement seems to be beating the brick chimney, one reason, perhaps, being its reduced weight on the foundations. The German system of building an elevated water tank round the chimney in industrial works is apparently going out of use, although in the north numerous elevated ferro-concrete tanks are to be seen with the bottom an inverted cone resting on a pillar.

One advantage of the fluted concrete chimney over those of concrete of the cylindrical shape is that the optical illusion of "swelled headedness" due to the deposit of black at the top end in contrast with the yellowy-grey of the concrete is avoided, and certainly few chimneys are more elegant than those of the new shape.

As a contrast to the concrete chimney, a cooling tower with brick outer walls was seen at Noeux-les-Mines, near Béthune; it looked very neat. Model houses for power-station operatives are a distinctive feature at several

modern stations in France (see fig. 2). It is not unusual, even in model factories, to find the house of a partner or of the managing director alongside the works; this system has the advantage that the worker feels that the boss is more approachable than when he lives perhaps miles away; and, further, the system must lead to more care being taken in the design of the works. The incidence of our inhabited house duty has at home done much to separate master and man.

It is interesting to hear of the way in which 6,000-kW sets are being moved about like pawns. At the Drocourt power station the turbine makers supplied a 6,000-kW set to take the load for a start, agreeing to take it back and replace it by a much larger set as soon as a material part of the station plant had been installed.

France is a country with large watersheds and therefore big rivers, but all the same in parts the problem of condensing water is a matter of some difficulty, especially in the mining districts. One of the largest power stations in the north of France before the war was at Wasquehal, between Lille and Roubaix-Tourcoing, which supplied power to many textile factories, and owing largely to condensing difficulties and lack of space, a new power station is now being erected at Comines on the Belgian border, a few miles away to the north. This station is being put up somewhat on the lines of Gennevilliers, but with 25,000-kW sets. The power station at Lomme, on the River Deule, near Lille, which was almost completely dismantled and smashed up by the Germans, has now been practically rebuilt, and a fine new power station erected in a remarkably short space of time on the "ashes" of the old station smashed up by gun fire and explosives, has now arisen on the River Oise at Beautor. Some of the French machinery is very well made, and some of the structural steelwork is ingenious and pretty.

Catenary Construction.

Owing to the smooth running, which facilitates high speed and the reduction in the number of supports, catenary construction is spreading even for d.c. normal pressure traction work. The illustration (fig. 3) shows a passing station on the Bayonne-Biarritz electric railway. This is run on a private right-of-way. It was originally standard gauge, run by steam; it has now been converted to metre gauge, so that eventually it can be extended along the coast to the Spanish border at Hendaye, about 18 miles away. The voltage is 650 V, d.c., power being supplied from the Pyrenees to a substation through overhead lines.

Lessons of the War.

The Frenchman, who even before the war was not nearly so anxious to turn his power stations and substations into showrooms for instruments and gadgets, as we were on this side of the Channel, has to a material extent learned during the war what can be done without. At that time, while the Service Electrique was buying simple switches and other gear and fixing them on quartering or anything handy, with us, on the contrary, marble or polished slate slabs with a multiplicity of instruments and circuit breakers, even when connected to petrol sets with no overload capacity, were hardly good enough for the then ignorant taxpayer to pay for. Of course the weaker a man is technically the more anxious he is to protect himself with gadgets.

One notes almost wherever one goes in France that there is a movement towards simplicity; people have found, for instance, that a hole through a large pane of glass, with or without a roof projection, is quite good enough for an inlet for a 45,000-volt line, although it should be noted—thanks perhaps to the efforts of the democratic sportsman and the comparative absence of game preservation—that there are fewer birds in France than in England. Difficulties through birds are not unknown in America.

The engineer of an important power company put the situation in this way: that many protective gadgets add more points of weakness than the extra security is worth. The French people apparently do not find it necessary to use highly complicated expensive relay schemes. It can be quite understood that the more unnecessary instruments there are to look at, the larger is the operating staff necessary to run the station; the smallness of the operating staff and labour is a not unusual feature of French power-station operation. It must not be forgotten, however, that the French Electrical Trade Union agreed some time ago to standards of technical knowledge and operative skill that would make many of our wiremen jump.

THE STATUS OF ELECTRICAL CONTRACTORS.

By H. R. TAUNTON.

The title rather begs the question. It assumes that electrical contractors have a status. Individual contractors, as individuals, may have one, but not as contractors. Their designation, with its variants, "electrician," "electrical engineer," conveys to the layman no more of qualification or responsibility than that of a jobbing plumber; and, to the initiated, something less than that.

Electrical Engineer! Electrician! Majestic titles which—if one could dissociate them from their all-too-common application—should conjure up a mental picture of combinations of Faraday and Watt, with a dash of Newton; Jovian beings, with subtle hands controlling the lightning, with dome-like brows sine-waving splendidly through a tangle of differential calculus and vector diagrams to the domination of Nature! All-embracing titles; shared alike by Edison and the purveyor of electric torches, by Sir Oliver Lodge and the youth who doses the bell battery! Empty titles—meaningless and worthless!

Anybody can go round to a cheap printer and order a few billheads, blazoning to the world the advent of yet another electrical contractor, electrical engineer, or electrician. The three designations are used impartially. There is no reason why they should not be, for they are certainly all of equal value—zero.

A wireman gets the sack for inefficiency. He sells his old motor-bike or his wife's sewing machine for working capital, and becomes an electrical contractor. A shift engineer who wants a change does the same. So does the enterprising cycle mechanic, the bright schoolboy with a taste for Meccano, the handy-man who has learnt to wire a bell push. They all become electrical contractors.

They stock some dark little shop in a by-street with goods "on appro." or "sale or return"; put a few cheap electrical "novelties" in the window, leavened with an odd Leclanché jar or spider fitting; wafer up a gaudy poster or two; and behold, they are "Lighting and Power Engineers—Complete Installations in Town or Country—Electric Bells a Speciality—Estimates Free." A wonderful fabric to be built up on the foundation of a pair of pliers and a yard of black tape!

Presently some misguided person gives them an order. They flourish. They buy the cheapest Continental wire and accessories and rubbish; or, if they are lucky, somebody's surplus stock. They pay their men—if the job is one they cannot tackle single-handed—with a share of

the "business," certainly not at T.U. rates. They keep their accounts in their head, and their correspondence in a manifold book.

Reckless, ignorant, and greedy, they undercut responsible firms, who are handicapped by conscience and a costs system, taking good work from them to spoil it. They flit from job to job, blazing a trail of liabilities for the fire insurance companies, till presently they vanish obscurely, until such time as they can get credit from another printer for new bill-heads in a fresh district; or their sister-in-law starts them in that last resource of the incompetent, the "fancy stationery," or a sweet shop.

But the memory of their misdeeds survives them. In black and white in the ledgers of too-confiding wholesale houses; in the thoughts and speech of the victims of their "jobs," and of all their friends and relations. "Electricity" gets a bad name. The supply company's load-factor suffers; so does the credit and turnover of the legitimate contractor; so, indirectly, does the electrical industry as a whole. The effect in one particular instance is small, perhaps; multiplied by the thousands of similar cases it is as large as it is deplorable.

But the will-o'-the-wisp jerry wireman is not the only offender against the good name of electrical contracting—nor indeed is he the worst. He has at least the merit of being evanescent. There are others whose offence is permanent—the thousand and one firms, big and little, to whom electrical contracting is a subsidiary issue.

Every plumber nowadays is also an electrical engineer; every ironmonger and toy-dealer gets trade terms as an electrician; every builder, decorator, furnisher, draper, and candlestick-maker has an electrical contracting department. In some obscure corner of a back shop lurks a dusty wholesale catalogue, and a wiring table as technical equipment; and there are repeated all the sins of the jerry wireman: shoddy work with unskilled labour and cheap material, bad costing, and reckless undercutting; with the same results to the detriment of legitimate contractors, supply companies, and the trade at large. Not also, unfortunately, in this case, to the detriment of the offenders. The electrical department, negligible in its turnover, can have little effect on the financial results of the main business; and so its iniquity continues, year after year, encouraged by the ignorance of the public, the trade terms of the wholesale houses, and the supineness of the real electrical contracting industry.

(We have to thank such firms, however, for the interesting estimate of the status of electrical contracting with which they present us; a contemptible "side-line," to be handed over to a junior assistant, or a foreman, "to see what he can make of it"; a rule-of-thumb affair, needing neither training nor experience.)

The genuine electrical contractor—and the others are not likely to be reading this article—will agree that this is no exaggerated picture of his local competitors. He will agree, too, that, as a general nuisance, they ought to be suppressed, for the good of the industry. The only difficulty is, how?

The answer to that question is the solution of the pressing problem of how to raise the whole tone of the electrical contracting industry, by standardising the quality of installation work, and regulating prices.

The obvious body to deal with the problem is the E.C.A. Probably the majority of the genuine contractors are members; certainly the majority of the others are not. Unfortunately there are a number of firms of standing who have hitherto not considered it worth while joining the Association. More unfortunately still, there are a number of members of the Association who are not firms of good standing (at least, as electrical contractors), whose only qualification is the ability to pay their subscriptions—mostly firms of the "side-line" class.

If the industry were properly organised *all* the reputable firms would be members, and *none* of the others would be. If that were the case membership of the Association would be equivalent to a guarantee of a definite standard of workmanship, on which the public would learn to rely. Just as at present nobody would dream of employing a solicitor not on the rolls, or an unqualified doctor, or even an unregistered plumber, so in time, by an intensive advertising campaign, people could be taught to employ only a contractor who was a member of the Association.

In other words, the solution of the problem is registration. Not the "voluntary" registration with which the E.C.A. is now amusing itself and the trade. That means nothing, and will effect nothing. Some 700 members of the Association will receive in due course a circular letter and a form which they will sign as a matter of routine. Several thousand other contractors will not receive it, and will therefore not be registered. The general public will be no whit the wiser, and we shall all be exactly as we were.

Registration, to be effective, must be compulsory. That does not necessarily mean by Act of Parliament. The E.C.A., if it be strong enough, can make it compulsory by the force of public opinion, educated by organised advertising. But to compel it must be strong.

There are many firms of repute who, at present, refuse to become members. They make out a case for their refusal. They say that the activities of the Association are neither very marked nor very helpful. But if every contractor of repute raised the same objection there would be no Association at all. Only by joining can the objectors point their objection to its present policy, or lack of policy, and assist in shaping a stronger and a better one. If the recalcitrants would but join there would be some hope of inducing the committee, with new blood in it, to get down seriously to the one thing that really matters: the strengthening of its organisation, and the elimination of the shoddy firms who hamper its efforts and discredit its very name.

The converse is equally true, and easier of realisation. If the E.C.A. would but eliminate these shoddy firms, membership of the Association would have a higher value, and the reputable firms who now object to associating with their jerry competitors would more readily be persuaded that their interests lay in adding theirs to the good names that would be left.

Elimination would be a comparatively simple matter, and one that, in itself, if judiciously advertised, would go a long way towards educating the public. It would only be a question of raising the standard of qualification for membership of the E.C.A.

In the first place, eliminate all those firms whose original, or chief business is not electrical contracting; all the plumbers, ironmongers, decorators, and jacks-of-all-trades. Cut them out entirely. Their activities are unfair and noxious to the genuine contractor. Apart from that, their interest in their electrical departments must always be subsidiary to their interest in their main businesses, and for that reason they cannot be expected to have at heart the interests of the electrical contracting industry. For the same reason they cannot be effectively controlled by an electrical organisation. From both aspects they are an obvious source of weakness.

All other candidates for membership would have to comply with certain conditions. The framing of these conditions would, of course, be the crux of the problem. It may not, perhaps, be easy, but there is no reason why it should prove impossible so to frame them that they would not unduly restrict the individual, or discourage the legitimate contractor in a small way of business.

Every wireman who, with little capital, starts in business as an electrical contractor, is not necessarily incompetent or a rogue. Many a big contracting business has been built up from the smallest foundations, and it would be manifestly unjust and impolitic to handicap by impossible conditions men ambitious and able to do the same. Whatever the conditions of membership they must be such as will allow fair scope to legitimate enterprise, however humble. At the same time, they must make impossible the unfair competition of the jerry wireman, while guaranteeing to the public,

employing members of the Association, work not below a definite standard.

The simplest and most obvious condition would be that all members should employ labour on the terms agreed with the E.T.U. This, not from any love for the E.T.U., but because the accepted scale of wages and conditions forms a basis for fair labour pricing.

The fair pricing of material is more difficult to regulate. Even if it were possible, it would not be in the interests of either contractors or manufacturers to insist that members should buy only from those groups with whom the N.E.C.T.A. has made agreements; nor indeed from any list of selected firms, however comprehensive. Any conditions regulating the prices paid for materials employed by contractors would have to be negative rather than positive. For instance, members might be barred from buying certain items of Continental accessories, not because they are Continental, or because they are cheap, but because they fall below the desirable standard of quality.

Alternatively, it would be quite practicable, without playing into the hands of manufacturers' rings, for the E.C.A. to draw up a complete series of specifications for all the materials commonly used by contractors, regulating broadly the minimum quality and the essentials of efficient design. Members would then have to agree to purchase only such goods as complied with "E.C.A. Specification." This would neither stifle competition among manufacturers, nor prevent judicious buying on the part of contractors. The Association would soon be strong enough to enforce its specifications on manufacturers, who would come, in time, to deposit samples with it, and then stamp their wares as approved by the E.C.A.

Another simple condition would be that all installations carried out by members should conform to a definite minimum standard, *e.g.*, the proposed modification of the I.E.E. rules. It would not be difficult to enforce such a standard, assuming the E.C.A. becomes a recognised power, which could count upon the co-operation of supply authorities and insurance companies, to report infractions.

Another condition might be that a certain proportion of the principals and managers of contracting firms should have certain defined qualifications, such as membership of the I.E.E., or apprenticeship with an approved firm, or so many years' experience in a position of responsibility.

A financial qualification would be undesirable, in the interests of the struggling beginner; but it would, perhaps, not be unreasonable to stipulate that he should have a registered office of a minimum rental. This would check the irresponsible individual who keeps his "store" in his bedroom, and conducts his business correspondence in the bar parlour, competing unfairly with firms who have to add standing charges to their labour and material costs.

All these conditions are calculated to check unfair competition, and, at the same time, they safeguard the interests of the public, guaranteeing them a certain standard of material and labour, combined in a workmanlike job by contractors of experience and responsibility. It would be the business of the E.C.A. to impress upon the public the advantages of such a guarantee; and it would not be long before they were realised. The time would surely come when no sane man would employ a contractor who was not a member of the Association; in other words, who was not registered as a qualified man whose work could be relied upon to pass a certain definite standard.

No contractor could then afford not to be a member of the E.C.A.; and with the power that would then be gained it would soon be in a position to secure the co-operation of the supply companies in the direction of refusing to connect up an installation carried out by an unregistered firm, so adding the final weapon of coercion to its armoury. Registration would have become in effect compulsory, to the benefit of the contractors, the electrical industry, and the public at large.

The present suggestion of voluntary registration is but marking time; a feeble shuffle which cannot possibly effect any improvement in the status of contractors. The alternative of preparing the ground for "compulsory" registration by first weeding out undesirable firms, and so enticing, and finally compelling, the others to join, is, to be sure, at first sight, a drastic policy. The first and obvious result would be a certain reduction of the volume of subscriptions, due to a temporarily lessened membership. But for every "dud" firm struck off the list, three or four firms of repute would hasten to join. Nobody values membership of an organisation which admits any Tom, Dick, or Harry who will pay his fee. Make membership of the E.C.A. a privilege; give it the cachet of exclusiveness; and every contractor with a reputation to keep, or to make, will clamour for admission.

In short, the first step in raising the status of the electrical contractor is to raise the status of the Electrical Contractors' Association.

FUEL ECONOMY PROBLEMS.

The Small Generating Station's Aspect.

By CHAS. F. WADE, A.M.I.E.E.

A study of the fuel costs of the smaller steam-driven generating stations, of from 500 kW capacity downwards, discloses an astonishing variation in the figures obtained from sets of plant approximating closely in general character. There appears to be no relation between load factor and the fuel cost to account for the variations, neither do local peculiarities, such as proximity or otherwise to coal fields, seem to have any definite influence upon the cost of coal per kWh sold.

The chief engineers of the smaller stations must feel very envious of their larger brethren whose undertakings are of such a size as to permit of the subdivision of the work among specialists in each particular branch of work included in the business of electricity supply. After all is said and done, the problems involved in the direction, management, operation, and maintenance of an electricity supply undertaking require as much versatility of knowledge for a small concern as in the case of a large one.

Bearing the above facts in mind, it is quite probable that it is the all-important human factor which is the principal cause of the otherwise inexplicable variations in costs already referred to. The chief engineer of a small undertaking is expected to have a full and complete knowledge of everything connected with the concern for which he is responsible, from the initial selection and purchase of the fuel right through to the legal points involved in enforcing payment of the accounts of defaulting consumers. The scope of the knowledge required for the successful carrying out of each individual department of any undertaking calls for almost undivided study to make a real success of the business, and it is not reasonable to expect the chief engineer of a small station to be a "superman" in

respect of all-round knowledge of several distinct branches of business any more than the manager of a 150,000-kW undertaking is expected to be.

The engineer, like everyone else, has a particular aptitude for one or another branch of the work in which he is engaged, and consequently tends to specialise in that particular section which appeals to him most. Thus, we find chiefs who are predominantly electrical men, others who are good business managers, some who are good mechanics, and so on. The same applies to the boiler house, where an engineer with a fairly good knowledge of chemistry and physics will secure the minimum possible consumption of fuel. Unfortunately, however, the layman, as represented by electricity committees, knowing little or nothing about the business for which he is supposed to be responsible to the ratepayers, is unable to realise the importance of these subdivisions of engineering work, and therefore expects the engineer to have abilities beyond the scope of any one man, though this expectation is not usually reflected in the salary paid.

Dealing more particularly with the fuel economy question, it is now admitted that to obtain uniformly good results with any boiler plant, it is essential that continuous attention be given to the working of the plant, intermittent visits being quite unsatisfactory; also the firemen must be properly qualified men with some sort of elementary knowledge, at least, of the principles of their work. These two essentials are unfortunately the most difficult to attain in the small station, where the duties of the chief and his small staff are spread over a large variety of work, and the local labour market affords but a poor selection of men for the important position of boiler fireman. The all-important matter of low fuel consumption is, therefore, largely left in the hands of firemen with but little experience of economical steam raising, as the little stations are mostly situated in non-industrial residential neighbourhoods.

Nevertheless, the difficulties are not insurmountable, even in those small stations whose margin for economy in coal consumption is insufficient to make the appointment of a full-time specialist in the boiler house a paying proposition. An examination of the returns of a large number of small undertakings gives the following results:—

	Capacity, kW.	Load factor, per cent.	Ann. output, kWh.	Coal cost per kWh, d.
Maximum	500	18.35	602,948	3.03
Minimum	132	9.26	82,630	1.10
Average	329	14.00	269,394	2.12

It does not seem unreasonable to assume that the coal cost should not exceed 1.62d. per kWh, or ½d. per kWh below the average. On an output of 270,000 kWh per annum this would represent a saving of £564 on the coal bill, a very important economy in a station of the size under consideration.

The writer has given a very great deal of thought to the problem of the small plant for some years, and from personal experience of both small and large undertakings is convinced that the question of fuel cost is mainly one of how much scientific knowledge of steam raising is brought to bear upon the work of the boiler house. Most of the little stations are equipped with plant of a type that should give a continuous efficiency of over 70 per cent., whereas the actual results, where definitely ascertained, are much below this figure.

The solution of the problem seems to lie in the provision of continuous recording instruments for CO_2, gas, and water temperatures, draught, steam pressure, and temperature, &c., with a water meter, the readings of which are tabulated hourly on a properly drawn-out log sheet. The records thus obtained, together with samples of the coal used and from the ash heap, would furnish any qualified expert with all the necessary information to enable him to submit a reasoned report on the working of the plant for the period covered and any particular part thereof. That it is worth while adopting this scheme will be evident from the following, the figures being based on the average station mentioned above, together with the results actually being obtained in a plant working to-day where the scheme is in operation.

The initial cost would be somewhere in the neighbourhood of £200 for the purchase and installation of the instruments, and the annual cost would approximate as follows:—

Maintenance and depreciation of instruments, at 15 per cent.	£30
Charts, pens, inks, posting, &c.	12
Services of specialist in analysing records, periodical visits, reports and advice	80
Total	£122

Setting the above figure against the estimated fuel saving of £564, there remains a balance of £442 to the good, the satisfactory nature of which needs no comment, which allows a very large margin for variation without risk.

Many chief engineers, no doubt, have a sort of feeling that to appeal to outside help in connection with the operation of their plant is to admit incompetence, but a little reflection will show that the adoption of some sort of system of expert supervision such as that outlined above, is only reproducing on a small scale what is done in the larger undertakings, where the plant is of sufficient size to justify the appointment of a full-time specialist for steam raising alone. Nevertheless, the small steam-driven station will never have a square deal, or show what it is capable of in the way of low fuel costs, until it has the same trained attention as the large plant.

In the plant referred to above as having adopted a similar scheme as that suggested, a saving of 25 per cent. on the fuel consumption has been effected, which should be a convincing argument in favour of the proposals.

The writer has mentioned the ideas outlined above to various well-known experts, who are unanimous that the solution of the small plant's fuel problem lies entirely on the lines indicated.

A Wire-Annealing Electric Furnace.—An interesting example of an electrically heated regenerative car-type furnace for annealing wire was recently put in operation at the works of the Fowler & Union Horse Nail Co., Buffalo. The plant consists essentially of three furnace chambers, each 12 ft. long, 7 ft. wide, and 4 ft. high. One chamber is employed for heating, one for cooling, and one for pre-heating. The first two are arranged in tandem with a common door between them, while the pre-heating chamber is placed alongside the cooling chamber with a full side opening between them to allow free interchange of heat from the hot to the cold charge. The total heating capacity is 180 kW, the windings being designed for direct connection to the 440-volt three-phase mains of the plant. Automatic temperature control is effected by means of a standard General Electric heater panel, actuated by a Leeds and Northrup two-point control instrument. The furnace cars, 12 ft. long, 6 ft. wide, and 30 in. deep, are heavily insulated, and have sand-seal troughs on all four sides, so that the furnace can be sealed when in service. The conveyor mechanism for moving the cars into and out of the furnace consists of two endless chains, parallel to each other, one being placed below the floor level in the centre of each car track. The material to be annealed is ⅛-in. wire, from which horseshoe nails are made. The wire is delivered to the furnace in coils weighing approximately 250 lb. each, the charge per car being about 7,500 lb. The cold charge is first placed in the pre-heating chamber, where it absorbs heat from the cooling charge for a period of three hours. It is then transferred to the heating chamber, where it remains for another three-hour period in a temperature of 1,360 deg. F., and finally it is taken into the cooling chamber, where it radiates heat into a new cold charge in the adjacent pre-heating chamber. The furnace thus delivers one 7,500-lb. charge of annealed wire every three hours. The labour required is remarkably small, being represented by the time of two men for a seven-minute period to operate the mechanical equipment for moving the cars and the furnace doors and also to load and unload the cars. This operation occurs once every three hours. When the furnace is working ten hours a day the power consumption is 185 kWh per ton of annealed product, but does not exceed 115 kWh if the furnace operates on a continuous 24-hour schedule.—*Eastern Engineering.*

DYNAMOS AND MOTORS OF COMPARATIVELY SMALL OUTPUTS.

By J. W. BURLEIGH, A.M.I.E.E.

The design and construction of small dynamos and motors is a matter of considerable importance in view of the great and ever-increasing demand for small power machines.

It must not be expected that this article will deal with the matter in nearly a complete manner. The subject embraces such a vast number of points that a volume would be required to deal with it comprehensively. It is hoped, however, that the observations and comments in these notes may be of some interest.

The manufacture of dynamos and motors cannot now be regarded otherwise than as an old industry, compared with the manufacture of many kinds of machines constructed at the present time.

The writer doubts, however, if in any class of machinery greater diversity of opinion exists with regard to the design of its principal members, the materials used, and the adjuncts often embodied, as in modern dynamo machinery. It can, to a certain extent, be understood why, for instance, one maker uses cast iron, and another cast steel for the yoke. For different factories, too, the design of the machine must, as far as possible, suit the particular manufacturing methods employed.

One finds that there is not that real approach towards standardisation which might be expected. Possibly this may be due partly to the fact that the kind of machinery now under consideration presents problems of a more scientific nature, and that consequently different conceptions prevail with regard to fundamental principles than in, say, a steam engine and certain other mechanical apparatus, the design of which is governed by fairly hard and fast rules which do not admit of such variations in design, as in the case of electrical motors.

It does seem a fact that, particularly in small machines, standardisation is further removed than it was some twenty-five years ago. Then one nearly always expected to find (there were notable exceptions) a smooth core drum armature with horse-shoe magnets. Even the commutator sections by different makers for a given output did not show such a wide variation in number as in present-day practice.

Even in small machines (say below 6 b.h.p.) it appears that there is no consensus of opinion as to whether two or four poles should be used. The use of four main poles and four interpoles for a 220-V, 4-b.h.p. motor certainly suggests that a limit has been reached so far as the number of poles are concerned. It is well known, too, that these small machines often have expensive laminated poles bolted to a steel frame. The use of a fan is common practice, even for the smallest output.

It is somewhat difficult to see why a four-pole machine should find favour for low output; compared with a two-pole motor the average voltage per section on load, for the same number of sections, is considerably higher, although not double, as one might at first sight expect having in mind the conditions when running light. The brush gear is much more complicated and expensive. There is a greatly increased number of parts. The frequency is doubled, a matter of serious moment, considering that very high speeds are often required in small machines. The armature is more costly to wind for a four-pole series winding than for the ordinary two-pole type of winding. The cost of production of the very small four-pole motor is considerably higher, a point which the writer believes will be conceded by nearly all, if not all concerned.

For quantity production (a most essential condition of manufacture nowadays) it is of vital importance that no part or member should be embodied in a design unless, by its use, it is most clearly established that there is a very real gain either in prime cost, efficiency, or performance. This is of the first importance alike to maker, factor, and purchaser—every non-essential member must be eliminated.

In considering the manufacture of a single machine, the incorporation of certain refinements often shows a real reduction in weight, and perhaps an apparent lessening of cost. The matter, however, assumes an entirely different aspect when quantity production is the aim.

It cannot be too fully emphasised that with the present labour charges it nearly always pays to spend a shilling more for material if sixpence can be saved in labour— a fundamental and obvious point which does not always appear to appeal as fully as it might to the scientific mind.

The relationship of material to labour is of great importance, but it is not proposed in this article to deal as fully with this matter as it deserves.

The writer proposes later in this article to describe a very simple design which he believes does, to a large extent, fulfil the design requirements for quantity production.

It may, however, be desirable to first state some of the main points which, in one way or another, affect designs generally, and to show the refinements which it is proposed to eliminate.

To enable one to properly make comparisons between different designs it is, of course, necessary to know several details underlying the constructions. It is well known to the designer that what might at first sight appear slight modifications in the design of small machines have often a marked influence on the weight and cost.

The principal points which occur to the writer, perhaps not in order of importance, are as follows:—

(*a*) Number of poles and nature of material used in them.
(*b*) Open or partly-enclosed slots.
(*c*) Thickness of slot insulation.
(*d*) Length of air gap.
(*e*) Temperature rise.
(*f*) Commutation.
(*g*) Efficiency.
(*h*) Nature of covering on the wires.
(*i*) Overload capacity.
(*j*) Fan ventilation.
(*k*) Interpoles.

In dealing with these points the writer will put forward certain data relating to the new construction, which it is hoped will enable the reader to make comparisons between this construction and other types.

(*a*) For simplicity and minimum cost, a two-pole construction is essential. It can be shown that cast iron only can be utilised for the magnets with great economy. Different designers have demonstrated this in numerous machines at present running. With the low-gap density usually found in small machines, and giving the pole tips a suitable shape, it is quite unnecessary to use laminated pole shoes. When using a solid pole face it may be desirable to use a few more slots in the armature, but the cost of this is small compared to fitting laminated poles. Hence lamination in the magnetic circuit is a refinement which does not find favour when quantity production is concerned.

(*b*) Partly-enclosed slots have certain advantages, but these advantages are outweighed by disadvantages found in the workshop. An armature having this type of slot is not so easily and quickly handled as one having slots of the open type. It might have been expected that the writer would favour the partly-enclosed slot, seeing that he advocates solid pole faces. Such, however, is not the case, as it is found in practice that, with due care in design, the open slot is quite satisfactory. Hence the partly-enclosed slot must come under the non-essential heading.

Armatures are often built with the laminations

arranged so that the axis of a tooth, or slot, is not parallel to the axis of the spindle. This refinement is out of the question where competitive quantity production is concerned.

(*c*) The question of slot insulation is an important one. It is most unwise to cut down the slot lining to very fine limits. At the same time it is quite unnecessary to provide anything like the thickness of insulation found in, say, a 500-V, 30-b.h.p. motor. Differences of opinion naturally exist as to the proper thickness of insulation for a motor of this output, but few designers would care to specify much less than .10 in. in width and .20 in. in depth for the total insulation over the double cotton covering.

In small machines it is found that, owing to the accommodating nature of a number of small wires and the general flexibility of the armature coils it is, in practice, preferable not to consider the actual definite dimension for the width or depth of the insulation, but rather to consider it as a product of the two dimensions —that is, within reasonable limits. The writer finds this a useful method of considering the matter, especially when, for a given frame, the same core plate has to suffice for all speeds and voltages. It is evident that with fixed-slot dimensions the various coils (which are, of course, composed of widely differing gauges of wire) must adapt themselves to the space provided. It is an essential condition that the same core plate and the same number of commutator sections must, for a given frame, be used for all voltages up to 500. This is an easy matter in two-pole construction with a comparatively small number of sections.

In the 30-b.h.p. motor referred to, the product of the insulation thicknesses equals .02.

For 220-V motors of, say, ½ b.h.p. the product lies between .011 and .013. For 500-V motors of the same output the product lies between .014 and .016. For 220-V motors of, say, 6 b.h.p. the product will lie between .014 and .017. For 500-V motors of this output the product will be between .016 and .02.

(*d*) A suitable length of air gap (actual clearance between pole and armature laminations) for the new design in shown on curve (fig. 2).

(*e*) Final temperature rise 75° F.

(*f*) The commutating properties of small machines should be such that with the brushes in the geometrical neutral position there is no sparking. Furthermore, the machine must withstand, without injury, 50 per cent. overload for short periods with the brushes in the position defined.

(*g*) For comparative purposes the weights to be given later will be based on the commercial efficiencies given in fig. 1.

It must not be assumed that the figures given are the maximum attainable. It is not difficult to obtain the top curve by slight additional weight, or by the method referred to later. The bottom curve, however, would more properly indicate the watts which can be lost, still keeping the machine well within a low temperature

(*h*) Considerable saving in weight can be made in small machines by winding the armature with silk-covered wire, and the field coils with single-cotton-covered wire.

The writer prefers to use fine double-cotton-covered wire for both the armature and field coils, and it is on the use of this covering that the data given are based. By the use of one kind of covering, the copper carried in stock is considerably decreased. With a machine designed in the first place for double-cotton-covered wire, it must not be overlooked that by winding the armature with silk-covered wire and the field with single-cotton-covered wire a considerable gain in efficiency can be obtained. It is very useful at times to take advantage of this when a very high efficiency is called for. Alternatively, when weight is a consideration, a greater output can be obtained. The reason for this is obvious—with silk-covered wire the next larger gauge of wire can nearly always be used in the armature, and single-cotton covering admits of a considerably greater amount of copper on the field coils. It will easily be seen that the extra price of the silk covering and extra weight of copper will run up the cost, but there certainly arise in practice occasions when it is justified.

The writer has an open mind with regard to the use of enamelled wire for the interpoles, but it must be confessed that he generally specifies double-cotton-covered, being impelled to do so largely by the question of stock.

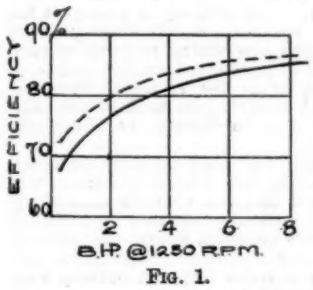


Fig. 1.

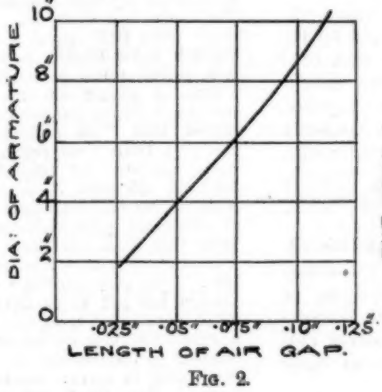


Fig. 2.

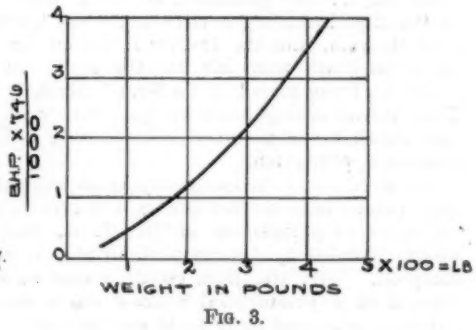


Fig. 3.

(*i*) The motors, for which the weight curve is shown in fig. 3, will easily stand the following overloads:—

Up to 1 b.h.p., 25 per cent. for ½ hour.
Above 1 b.h.p., 25 per cent. for 1 hour.

(*j*) A fan is certainly considered a non-essential member, and would not find favour in a design which aimed at simplicity.

(*k*) With motors up to 250 volts, and with two-pole construction, it is not difficult to obtain the commutation requirements as set forth under (*f*) without the use of interpoles. Above 300 volts it is wise to use interpoles. It is also necessary to use them for the lower voltages in the case of variable-speed motors above 2 :1 speed ratio and where extra heavy duty is required.

(*To be concluded.*)

A Large Californian Undertaking.—The Pit River development of the Pacific Gas & Electric Company was started a year ago and now the power house, costing upwards of $6,000,000, is nearing completion. The plant will develop 93,000 h.p. when completed and will be ready for operation about September 15th. A 220,000-volt transmission line 210 miles long will connect the plant with the Vacaville substation, and 70 miles must still be covered by another line before San José Mission is reached and the power is delivered at San Francisco.

The whole Pit River development is expected to reach completion in 1935, at a cost of more than $100,000,000, or an annual expenditure of about $8,000,000. The power developments mapped out are: Pit No. 2, 23,500 h.p.; Pit No. 3, 90,500 h.p.; Pit No. 4, 107,200 h.p.; Pit No. 5, 250,000 h.p.—*Electrical World.*

E

MUNICIPAL TRAMWAYS ASSOCIATION (INC.)—II.

ANNUAL CONFERENCE.

The first day's proceedings of the Conference were attended by wretched weather conditions in Newcastle. The Lord Mayor (Alderman R. H. Millican), attended by the Sheriff (Councillor James Lunn), the town clerk (Mr. A. M. Oliver) and many members of the Council, extended the city's welcome. The Lord Mayor said that on its first visit to Newcastle, the Association was celebrating its majority. It had honoured the city by electing as its president for the year Alderman Richard Mayne, chairman of the Newcastle Transport and Electricity Committee. As a municipality, Newcastle recognised what Alderman Mayne had done during the past few years in connection with the city tramways. He believed that the coming year would be a most difficult one for tramways and other municipal undertakings throughout the country, for it would bristle with anxieties arising from financial, labour, and industrial problems.

The Lord Mayor's welcome on behalf of the city was briefly responded to by the president, and on the motion of Sir John Timpson, Portsmouth, vice-president, seconded by Mr. A. L. C. Fell, London, the Lord Mayor and Sheriff were thanked for their greetings and presence.

A special programme drawn up for the ladies was then entered upon. Directly after the reception by the Lord Mayor, they proceeded in motor 'buses to a tour of the city, including a visit to the old Castle, Blackgate Museum, and the Trinity House on the quayside, and after lunch they left for the coast *via* Gosforth Park, tea being served at the Grand Hotel, Tynemouth. Their initial outings were not pleasant, owing to incessant rainfall, but nevertheless there were many expressions of appreciation.

The President (Alderman Mayne) having read his address (which is abstracted below), was cordially thanked for it, on the proposition of Mr. J. B. Hamilton, of Leeds, seconded by Alderman S. Craddock, of Wolverhampton. Mr. Hamilton observed that he never had listened to a presidential address which showed more vision or contained more lucid statements.

Afterwards the papers of Mr. Ernest Hatton and Mr. P. M. Heath were read and discussed.

Alderman Richard Mayne presided at the second day's proceedings of the Conference. The weather was again wretched, and completely spoilt the pleasure outing of the lady visitors, who were conveyed to Jesmond Dene, where they were entertained to luncheon; afterwards they were shown over the offices of the *Newcastle Chronicle and North Mail*, where they saw the complete production of an issue of the evening paper.

Meanwhile, a paper was read by Mr. E. S. Rayner, general manager of the Hull City tramways, on "Tramway Rolling Stock"; an abstract of the paper was printed on p. 368. After this had been discussed, Mr. H. Mattinson, general manager of the Manchester City Tramways, read a paper on "Highways Costs Borne by Tramways," and a discussion followed.

At the concluding session on September 15th, Sir John Timpson, K.B.E., chairman of the Portsmouth Tramways Commitee and vice-president of the Association, was unanimously elected president for the ensuing year, and it was resolved that the next conference of the Association should be held at Portsmouth.

Mr. J. M. McElroy, one of the pioneers of the Association, who has lately retired from the post of general manager of the Manchester tramway system, and who has also retired from the Council of the Association, was elected an honorary member of the organisation.

Alderman W. G. Wylie, South Shields, was re-elected a member of the Council, to which Alderman S. Craddock, Wolverhampton, was also elected, both being selected to represent the Associated Tramway Committees. To represent tramway managers on the Executive Council, Mr. James Dalrymple, C.B.E., general manager, Glasgow, and Mr. T. B. Goodyer, general manager, Croydon, were re-elected; and there were also appointed Mr. P. Priestley, general manager, Liverpool, and Mr. W. Chamberlain, general manager, Oldham.

The newly-elected president, Sir John Timpson, and the general secretary, Mr. J. Beckett, were appointed to represent the Association at the International Convention of Transport Authorities to be held in Brussels in October.

Votes of thanks to the retiring president and to all those who had assisted in making the Conference a success were cordially carried. Later the members of the Association motored to Chollerford and visited the Roman camp at Cilurnum.

Presidential Address.

By Ald. Richard Mayne, J.P.,

Chairman, Newcastle-upon-Tyne Transport and Electricity Committee.

(*Abstract.*)

To-day we celebrate the 21st anniversary of the formation of this Association. Out of a total of 102 municipally operated tramways, 95 are now members of it. It has become a custom in some quarters, not suspect of altruistic motives, to declaim against tramways undertakings and assume that they have had their day. It is 57 years since public tramways were first operated in this country, and in 1921 they carried 4,863,968,000 passengers; the capital outlay was £62,293,000 (local authorities) and £23,849,000 (companies), a total of £86,142,000, the former carrying 3,949,138,000 and the latter 914,380 passengers. The Ministry of Transport has stated that "In 1920-21, tramway undertakings received £939,004 from local rates, and contributed in relief of such rates £53,594. In 1913-14, they received £62,600 and contributed £589,886. . . .In spite of the increased fares the ratio of working expenses to receipts rose to 86.49 per cent. as compared with 80.55 per cent. in 1919-20. In 1913-14 the ratio was 64.35 per cent."

It is obvious that tramways have met a great public necessity. That they continue to do so is beyond question. The vehicle has yet to be devised that can compete successfully with them in carrying our industrial population by means of a regular service at low fares on equal terms, especially in relation to the burdens of rates, taxes, and maintenance that they have to carry. On equal terms they can outstrip with ease all their rivals and competitors.

Sir Henry Maybury recently said that there would now appear in equity to be a case for the tramway undertakings against the ordinary commercial user. As Parliament had put the obligation on them they should go to Parliament for relief, and officially he would not be against them. If they obtained relief, they should be brought into a scheme of taxation, and a charge should be made on the seating capacity of the tramcar; the track, which was now the responsibility of the undertakers, being transferred to the Highway Authority. This indicates that it may be necessary to take action by means of a private Bill and fight out the issue in the House of Commons. Parliament should be pressed to remove a manifest injustice.

We have never claimed a monopoly, but we claim either freedom from exactions not placed on other passenger transport systems, or that the same exactions be levied on our competitors. The London Underground Railway group, however, had put forward a proposal involving freedom from omnibus competition for ten years, together with a Government guarantee of interest on a sum of £6,000,000. The Metropolitan Municipal Tramways Council had stated that a Government guarantee of this nature would result in placing the municipal undertakings at a still greater financial disadvantage, by permitting the Underground group to subject municipally-owned tramways to a subsidised competition by their buses. The municipal tramway undertakings had a still greater right to such support, and the Council urged that no such monopoly should be granted to any private undertaking.

Road transport competition and big schemes of road widening and adaptation to heavy modern mechanical vehicles, which are not adapted to many existing roads, the fierce progress in the wear and tear on roads, the character and the measure of taxation upon mechanical road vehicles—these are subjects with which the financial interests of all local authorities are closely bound up. They raise issues of overwhelming importance; they affect seriously the oppressive burdens of local taxation; they bear directly upon the interests of the members of this Association, but even they do not throw into true perspective the vital difference between a pirate or vagabond service of passenger transport, which is out in fine weather and at favourable times, and in when it is wet and unfavourable, and a regularised and efficient ser-

vice, operated all the time at the lowest possible cost for the public advantage.

Engaged as we are in operating a publicly-owned passenger service, concerned only with efficiency and cost price whenever we can get it; not impelled or stimulated by motives of profit, we fear no competition under fair conditions, and, if nothing short of monopoly can secure to the community a self-sustaining and efficient service, then, on broad grounds of public policy and in the public interests, we place our claim as high as that of a monopoly.

The subject of unemployment insurance is being considered by the Executive Council; the industry is contributing £150,000 per annum to other industries whose unemployment is greater, and as it was the policy of the Government to encourage industries to administer their own schemes for dealing with their unemployed workpeople, to accept this encouragement and provide a "special scheme" would be sound policy.

An Argument for the "Penny Fare" demonstrated by Actual Experience.

By Ernest Hatton, General Manager and Engineer, Newcastle-upon-Tyne Tramways. (*Abstract.*)

Owing to advancing working costs it was found necessary to raise the minimum fare; some undertakings made this 1½d., and some 2d. The present tendency is, however, to revert to the 1d. fare. However long a distance may be given for a high minimum fare it places the tramcar beyond the reach of many, especially in the case of a large household of children. Therefore, the scale of fares must be as low as is consistent with the financial safety of the undertaking. Taking the Newcastle Corporation system as an example, it is seen that up to 1917 by keeping the long-distance fare low and giving a good ride for a penny, good results had been obtained. In 1920 the percentage of costs to receipts had increased so heavily that revision of fares became necessary. There were many advocates of a 1½d. minimum fare, but it was finally decided to retain the 1d. fare and also the ½d. children's fare. The principal change was a curtailment of the 1d. fare distance from 2,800 to 2,000 yards. The revision was estimated to produce from sixty-five to seventy thousand pounds; it actually produced eighty thousand pounds at the time. Further increases in wages absorbed this extra revenue and necessitated another revision. It was decided, however, to meet the emergency by a reduction in working costs, and as the wages of employés were fixed by national agreement, the Corporation seceded from the industrial councils and agreements. Receipts are falling, due to lack of employment generally, and it would be a preposterous condition that the workers who use the cars should subsidise the workmen in the cars. During the whole of the period nothing had been done to deprive the long-distance rider of any privileges, while the 1d. and ½d. passengers (and they are still 40 per cent. of the total) are given a quick service and are carried a reasonable distance.

The author is not in favour of altering the value of the penny; conditions must shape themselves to suit the nation's coinage—not *vice versâ*. The great increase in traffic following the introduction of electric traction was not gained by increasing fares, but by fare reduction and quick services. This policy should be pursued still.

Discussion.

Mr. A. Baker (Birmingham) said he would be very much surprised if more than half-a-dozen persons agreed with the paper in its entirety. The thesis of the paper was that fares ought to be brought back to pre-war level, and that the only way to accomplish that was to reduce working expenses. Wages represented 60 to 65 per cent. of the total costs, and to reduce fares to pre-war level meant that wages must be brought down to that standard, or lower. Tramwaymen to-day were getting 130 to 140 per cent. more than they were receiving in July, 1914, and compared with other industries, they were getting something more than the market value for their labour. Doubtless reductions would have to take place. That matter was being dealt with by the National Joint Industrial Council. Did anyone imagine, however, that wages would ever come down to the 1914 level? He thought—indeed, he hoped—they would not. The worker was entitled to a higher standard of living than he had enjoyed in 1914. Tramway fares had always been too low in this country to provide sufficient margin for emergencies. The only way in which they could be made self-supporting was to make the passenger pay the cost of his ride. To suggest that fares could be brought back to pre-war level was as fallacious as it was pernicious.

Mr. W. Murray (Walthamstow) argued that it was impossible to make conditions that would be applicable to the whole of the country.

Councillor Waite (Coventry) said that ideals were impossible under present conditions, and tramways must be made to pay.

Alderman C. Higham (Blackburn) said the smaller undertakings could not afford to have a penny fare on the present rate of running costs.

Councillor W. G. Turner (Belfast) considered that each system should be a law unto itself, so far as fares and distances were concerned.

Alderman F. Smith (Liverpool) said tramways were a cash affair, and those who could not make them pay should not be allowed to own them.

Councillor B. Clarkin (Walthamstow) favoured free rides, but as the ideal was unattainable at present, he gave his support to the penny fare.

Councillor Woffenden (Huddersfield) said there was no justification for asking the ratepayers to subsidise the tramways.

The President said a man ought to be able to get on a car for a penny. If they could not carry him a long way, let him be carried a short way, but let him use his penny.

Mr. J. Barnard (Bolton) contended that Newcastle could not afford to run its cars on a penny fare. Had Newcastle set aside a sufficient sum of money for renewals and depreciation as put forward at the Court of Inquiry, instead of a deficit of £2,667 last year, the deficit would have been £63,000.

Mr. James Dalrymple (Glasgow) said that if the penny fare would not yield sufficient revenue to defray expenses, it was useless considering it.

Mr. H. P. Stokes (Plymouth) said the sooner undertakings aimed at getting back to the penny fare the sooner would there be a revival in industry.

Mr. Hatton, in reply, said he had not argued for a reversion to the penny fare; it could not be done at the present time. Last year, Newcastle tramways, after three weeks' holiday, cost the undertaking £13,000. Before that, because of the coal strike, the undertaking had switched on to oil fuel, and the two items together cost £20,000. But for these items there would not have been a deficit of less than £3,000; there would have been a handsome profit. Out of revenue they had purchased 'buses which had cost £40,000, and they had built and equipped a power station and four sub-stations.

The Legal Aspect of the Question of Electrolysis.

By P. M. Heath, Town Clerk, Manchester.

(*Abstract.*)

The question of the legal liability of tramway undertakers for damage occasioned by the leakage of electric currents has attracted attention consequent upon the decision of the Court of Appeal in the recent case of the Postmaster-General *v.* the Blackpool and Fleetwood Tramroad Co., Ltd. In the circumstances of this case, it was held by the Court of Appeal that the Postmaster-General was entitled to recover certain sums expended on the repairs to Post Office cables, which had been injured by the leakage of electric currents from the tramway system. This case was decided upon the special provisions, in favour of the Postmaster-General, contained in the company's Act of 1896, and it is not to be regarded as an authority in claims for damages for electrolysis from others, such as water and gas undertakers.

The question of nuisance and damage from escaping electric currents used in connection with a tramway undertaking first engaged the attention of the High Court in the year 1893 (National Telephone Co. *v.* Baker). By reason of the escape of electric currents from the tramway system, disturbances were occasioned to the company's telephone wires.

Kekewich, J., ruled that the act complained of was done in pursuance of a provisional order confirmed by Act of Parliament and was protected to the same extent as other nuisances under statutory authority. The defendant being expressly authorised to use electric power, the Legislature must be taken to have contemplated it and to have condoned by anticipation any mischief arising from the reasonable use of such power.

The National Telephone Co. enjoyed no special statutory protection, and was, as regarded claims for damage by electrolysis, in no better or worse position than water or gas companies.

A Joint Committee of the House of Lords and of the House of Commons reported in July, 1893, that the Board of Trade should have power to make regulations to secure the best system of working electrical tramways and railways, and a clause was agreed, requiring the undertakers to take all reasonable precautions so as not injuriously to affect, by fusion or electrolytic action, any gas or water pipes or other metallic structures, or to interfere with the working of any line or apparatus used for the purpose of transmitting electrical power, or of communication. The undertakers are deemed to take all proper precautions, if they employ means of preventing injurious interference as prescribed by the Board of Trade Regulations.

Clauses for the protection of the Postmaster-General were reduced to a common form in 1911, and such require the undertakers to use every reasonable means to prevent injurious affection to telegraphic lines or currents therein.

The case of the Postmaster-General *v.* Blackpool and Fleetwood Tramroad Co., previously referred to, is instructive as to the construction which has been placed upon language similar to that contained in the model clause.

It was contended by the defendants that they were not liable, for the telegraphic lines of the plaintiff were injuriously affected, not by the working of the defendants' undertaking, but by plaintiff's own negligent act. The Court held that neither the fact that the defendants had used every reasonable means in the working of the undertaking to pre-

vent injurious affection of the plaintiff's cable, nor that the plaintiff by laying his cable so near to the defendants' lines had courted the injury, afforded any defence.

It will therefore appear that notwithstanding that the Postmaster-General be negligent in selecting the place for his telegraphic or telephonic cables, if these are injuriously affected by the construction or working of a tramway line, the Postmaster-General is entitled to require the tramway undertakers to pay the expense of all alterations that may be necessary to remedy such injurious affection.

It is submitted that an alteration of the law is necessary—and that the proved negligence of the agents of the Postmaster-General should disentitle him to recover the cost of alterations.

Discussion.

Mr. A. L. C. Fell (London County Council) moved that the Executive Council be asked to appoint a technical committee to meet the experts of the Postmaster-General and the Ministry of Transport for the purpose of clearing up the position. Mr. J. Gordon (Liverpool) seconded.

In supporting the resolution, Mr. J. B. Hamilton (Leeds) said that after every precaution had been taken they were still liable for heavy damages. He believed the Association could at least get a modification of what promised to be a very serious charge on some undertakings. At present they were liable if the Post Office claimed injury, even without proving it.

Mr. C. J. Spencer (London) suggested that the Tramways and Light Railways Association should be asked to co-operate in the matter, and this was embodied in the foregoing resolution and adopted unanimously.

This ended the first day's proceedings.

INDIAN NOTES.

(From Our Special Correspondent.)

A very promising institution has been established in the Punjab, called the Punjab Electricity Board, whose work is to meet at intervals to discuss with experts and other officials possibilities of electrical development in that province. The first regular meeting of the Board was held in Simla in June with the Minister of Industry, who is a prominent Indian, in the chair. The principal business was a discussion of the merits of the Sutlej Valley hydro-electric scheme as a by-product of the main irrigation works. The chief engineer opposed the electrical scheme for two reasons, one being that its financial prospects were bad; the other being that the necessary regulation of the flow of water for turbine work would give rise to serious complications and interfere with the main irrigation project. Colonel Battye, the hydro-electric expert, explained the advantages and disadvantages of such a scheme. No immediate decision appears to have been arrived at.

Afghanistan.—The possibilities of business with this country are becoming more encouraging. The large hydro-electric plant installed a few years back is proving its utility, and further developments are likely to take place in the near future. The representative of a large local firm of engineers has been invited to go to Kabul to work out details of a new project and submit estimates. Among the 90 students from Afghanistan, who recently went to Europe to complete their education, there are several who are destined for the electrical engineering service.

Owing partly to the belief among people of the East in the efficiency of German educational methods and in part to the depreciation of the mark, many of these students have gone to Germany for training.

The complaint of the Indian student who goes to England for training is that he is left too much to his own resources in workshops which he joins; nobody troubles about him; he meets few among his acquaintances who are keen in their work, his shop companions being mostly interested in football, racing, kinemas, and such other, to him, uninteresting trivialities. Again, he has to remark on the colossal ignorance about India, which is so obvious in England—and so painful to an Indian. These matters, which may seem trifles, get discussed and talked about when a student returns, and hence it is that many decide to go to Germany, America, or even Japan, where more attention seems to be paid to Indian students.

Shillong.—This fascinating little hill station in Assam is formulating plans for giving its inhabitants the benefits of an electricity supply. The Shillong Hydro-Electrical Co. has been formed, and, under certain conditions, has been granted a concession for 31 years—one of the conditions being that the municipality pays one anna per unit less for its consumption than the general public. As Shillong is very close to Cherapoonjee, which has the largest rainfall in the world, *viz.*, 428 inches average, it looks as if the project should be a success; but, of course, this huge rainfall is only seasonal. If a light electric railway could be run from Gauhati to Shillong, a distance of about 64 miles, it would add much to the comfort of visitors and to the prosperity of the town.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS FOR AUGUST, 1922.

The returns of electrical exports for August show an appreciable improvement on the July position, the month's exports having advanced from £809,915 in July to £863,637 in August. The electrical imports also showed a similar but more marked tendency, the total £318,432 for August comparing with £184,979 for July. The re-exports were valued at £12,943 as compared with £15,246 for the previous month.

Generally speaking, all sections of the exports, except batteries and accumulators and electrical machinery, were at a higher level than in the previous month, the principal increases occurring in submarine telegraph and telephone cable, and telegraph and telephone instruments and apparatus, while glow-lamp exports were also considerably in advance of the July figures; on the other hand, electrical machinery records were lower by £25,000, and battery and accumulators by £18,000 than in the preceding month.

In the electrical import section electrical machinery values advanced by more than £100,000, while telegraph, telephone, and glow-lamp imports were also on an extended scale.

Values of Electrical Exports and Imports for August, 1922.

	Exports. £	Imports. £	Re-Exports. £
Electrical goods and apparatus ...	105,386	33,958	3,871
Insulated wires and cables ...	153,591	19,937	32
Glow lamps	37,808	10,593	709
Arc lamps and parts...	219	571	7
Batteries and accumulators ...	25,209	20,210	478
Meters and instruments	33,738	5,844	1,235
Carbons	6,572	1,957	431
Electrical Machinery.—			
Railway and tramway motors ...	11,666	—	—
Other motors and generators ...	113,634	—	—
Switchboards (not telegraph or telephone)	5,293	428	—
Electrical machinery (unenumerated)	123,588	174,934	4,733
Telegraph and telephone cable and material.—			
Telegraph and telephone wire and cable (not submarine)	750,759	—	—
Submarine telegraph and telephone cable	46,782	1,053	130
Telegraph and telephone instruments and apparatus	149,392	48,947	1,317
Totals	£863,637	£318,432	£12,943

A Durability Test.—Messrs. Mawdsley's, Ltd., of Dursley, have sent us the following letter from a customer:—"With regard to one of your standard 25-h.p. motors. The above machine was placed on a pumping set which unfortunately was drowned owing to a large in-rush of water into the mine, and was submerged for five weeks under 90 ft. of water. When the machine was recovered, only the lifting eyes were visible, the rest was in a mud bank. The armature could not be extracted owing to the mud, so this thick mud was swilled out by means of a hot water hose. The machine was dried out with heater elements without dismantling, and the test of all windings to earth was 1.2 megohms. The machine was next put on a haulage, and has since given six months' service without a moment's trouble of any sort. I think this is a remarkable performance for an open-type standard machine."

ELECTRICITY SUPPLY ADMINISTRATION.

The report of the Minister of Transport respecting the applications to and proceedings of the Ministry under the Electricity (Supply) Acts, 1882 to 1919, during the year ended March 31st, 1922, has recently been published (H.M. Stationery Office, 9d. net).

The approved estimated net expenditure of the Electricity Commissioners for the year was £44,000. This is being defrayed from the Exchequer, making a total advance, including interest, of £90,796, which has to be repaid by annual instalments by March 31st, 1925. As from April 1st, this year, the Commissioners' expenses are to be provided directly by the electricity supply industry.

During the year 31 Special Orders were confirmed by the Minister, and a further five awaited confirmation on March 31st. Most of these have been mentioned in previous issues of the Electrical Review at the time of their being made by the Commissioners. Apart from the Orders included above, the Minister has also confirmed a bulk supply agreement between the Wolverhampton Corporation and the Cannock Urban District Council; and an application for a Special Order made by the Bootle Corporation, permitting it to use the water of the Leeds and Liverpool Canal is also under consideration. Under the Statutory Undertakings (Temporary Increase of Charges) Act, 19 Orders have been made modifying the charges which may be made by the undertakers concerned. Increases in the maximum price which undertakers are permitted to charge have been allowed in 24 cases; it was found necessary to hold only five inquiries in this connection.

Extensions of the time in which works are to be carried out have been granted to five authorities. An extension of the time in which it may decide to purchase the local undertaking of the Urban Electric Supply Co., Ltd., has been allowed the Newton Abbot Urban District Council.

Twelve Electricity Orders have been completely revoked; the parts of two Acts relating to electricity have been cancelled; and the area defined in the Runcorn Electric Lighting Order, 1910, has been curtailed. Consideration of the revocation of a further eight Acts (in so far as they apply to electricity), and Orders has been deferred. In five cases permission has been given to break up streets, not repairable by the local authorities, for the purpose of laying cables.

An interesting feature of the report is the section announcing that no less than 46 authorities have secured permission to erect overhead lines for the purpose of supplying electricity. Two applications for consents to wayleaves came up for consideration. One of these, made by the undertakers under the North Wales Electric Power Act, 1904, for consent to a wayleave for certain parts of the route of an overhead line from Dolgarrog to Colwyn Bay, was granted; in the other case the undertakers under the Portishead and District Electric Lighting Order, 1911, applied for, and were refused consent for, a wayleave across a field.

The latter part of the report gives an outline of what the Electricity Commissioners' report will be. It first mentions that two more electricity districts have been delimited, *viz.*, the West of Scotland and the East of Scotland. The Commissioners have given their consent to the erection of eleven new stations, representing a total initial installation of 30,660 kW. Authorised extensions of 50 existing stations represent approximately 143,700 kW of generating plant. In addition to the applications not disposed of at the date of the last report, the Commissioners received 394 applications from local authorities for sanction to borrow funds for the purposes of their electricity undertakings. Sanctions were issued in respect of 389 applications, the total amount sanctioned being £13,708,385.

At the commencement of the period covered by the present report the Commissioners had before them 27 applications for Special Orders under Section 26 of the Electricity (Supply) Act, 1919, and during the period covered by the report received another 43. Of these applications the Commissioners made Orders in 33 cases. In one case an Order was granted despite the refusal of consent by the local authority for the parish of Bedworth. Approval was given in seven instances to agreements between undertakers for mutual assistance or bulk supplies. Fifty-eight Orders were made permitting undertakers to supply electricity to specific premises situated outside their areas. Special systems of supply were sanctioned in the case of 28 undertakings. The Commissioners have dealt with a number of applications referred to them by the Unemployment Grants Committee for approval of electricity works proposed to be carried out by local authorities with the aid of grants from the Committee; they have also assisted the Trade Facilities Act Advisory Committee in a consultative capacity.

An appendix to the report shows the position, as at March 31st, with regard to the electricity districts delimited by the Commissioners. This has been followed closely in our pages as the various steps have been taken.

LEGAL.

James Keith & Blackman, Ltd., *v.* B. Barnett (Electrical Engineers), Ltd.

Before Mr. Registrar Dell, in the Mayor's & City of London Court, on September 14th, a claim was made by plaintiffs, of Farringdon Avenue, E.C., against defendants, electrical engineers, 125, Whitechapel Road, for £4 10s. 6d. for work done.

Plaintiffs' representative said the defendants ordered two ventilating fans, and after delivery found one of the fans wanted altering. They also required two fresh switches. The fan was altered and the switches were supplied, the amount sued for being the price. The goods had been supplied exactly as ordered.

Defendants' representative said that they were erecting a public building for the L.C.C., and required two ventilating fans. Plaintiffs' representative called and he was shown the plans which required two ventilating fans, one to take the air out and the other to send the air in. The plaintiffs' representative gave the price of the fans required, which was accepted, and the fans were ordered on plaintiffs' representative's selection. The account was paid before the fans were delivered on the job. Afterwards it was found that a mistake had been made in the fans supplied being both alike.

Plaintiffs' man said it was simply a matter of reversing the blades of one of the machines. The switches that were sent were considered a danger to the public and others were to be sent. The motors were guaranteed, so far as workmanship was concerned, for 12 months. Two or three days after the alterations and delivery of the fresh switches, a bill was sent to them for £4 10s., for which they considered they were not responsible.

Mr. Registrar Dell said, in order to deal with the matter properly, he would require the attendance of the plaintiffs' representative to whom the order for the fans was given. At present he had only the defendants' version of the interview. He would not deprive the plaintiffs of their right to recover, which would depend on what the plaintiffs' representative would say. He did not want to encourage the plaintiffs to bring the matter on again unless they had strong evidence that the defendants were responsible. He was fairly satisfied from what the defendants' representative said that the plaintiffs would have a difficulty in making them responsible. The case was adjourned.

A South African Trade Union Case.

The case of an electrician who sued the South African Council of the Amalgamated Engineering Union for £5,000 was recently dealt with by the Appeal Court at Cape Town. In December, 1920, the Union expelled an electrician named A. E. Young, on the ground that Young had accepted an increase of ten per cent. offered by the Johannesburg Municipality to certain employés, while the question of acceptance was still under consideration by the Society. In consequence of his expulsion, plaintiff was given twenty-four hours' notice and dismissed from his employment by the Municipal Council. The case previously came before the Witwatersrand Local Division, which court reinstated Young as a member of the Union with full rights and privileges. He was not, however, re-employed by the Municipal Council. Against the decision of the lower Court the Union appealed, and the Appeal Court upheld the appeal with costs in both Courts.

Steel Erector's Widow Awarded £300.

In the Shoreditch County Court, on September 12th, before Judge Cluer, there was an application, under the Workmen's Compensation Act, by the widow of George William Hood, of Romford, a steel girder erector, against Mr. W. J. Cearns, a builder, of Stratford, for compensation for the death of her husband. It appeared that on July 14th the deceased man was erecting a steel girder at the Shoreditch Electricity Works, when he fell and fractured his skull. He died as a result of his injuries. A claim was made of £300 for compensation for the widow, and this was admitted.

"Drawback" Allowance on Goods for Australia.—The High Commissioner for Australia in London has been informed by the Commonwealth Government that exporters of goods to Australia are now at liberty to use the form of invoice declaration recommended by the Imperial Customs Conference, which will be adopted as an official requirement from January 1st, 1923. As this form provides for the insertion of a statement as to the amount of any "drawback" or remission of duty which has been or will be allowed on exportation, its use obviates the need for a supporting certificate from the Customs authorities of the country for export, hitherto required in the case of goods exported to Australia under "drawback."—F.B.I. *Bulletin.*

BUSINESS NOTES.

Bankruptcy Proceedings.—Frederick Hungate Dennis, 124, New London Road, and 21c, High Street, Chelmsford, late 20, High Street, Chelmsford, Essex, electrical engineer.—The first meeting of the creditors was held on September 15th at 29, Russell Square, London, W.C.1. The Official Receiver, who presided, stated that he had not yet been able to issue the usual report to the creditors, but, according to the statement of affairs, the ranking liabilities were £841. There were fully-secured creditors for £693 holding securities consisting of a mortgage on 124, New London Road, and a charge on a life policy. From those two securities there was a surplus of £270, but a portion of that went to the partly-secured creditors. The surplus carried to the assets amounted to £245. The total assets amounted to £615. Debtor attributed his failure to insufficient capital and general depression in trade. The matter was left with the Official Receiver as trustee of the estate.

Jervis St. Vincent Clegram Farrant, electrical engineer and merchant, 14, Queen Victoria Street, E.C.—The public examination of this debtor was held on Tuesday last week before Mr. Registrar Mellor at the London Bankruptcy Court, the accounts showing liabilities £8,692 and assets valued at £54,486, chiefly consisting of claims and book debts. Replying to Mr. W. P. Bowyer, Senior Official Receiver, the debtor stated that for many years prior to 1908 he was employed in various parts of the world as an electrical engineer, but then commenced business on his own account as an importer, and subsequently as a broker and merchant. In 1917 he ordered 15,000,000 electrical pocket batteries from a firm in New York, the purchase price being six shillings a dozen; he received about 960,000 of these batteries, but the balance was not shipped owing to import restrictions, whilst about one-half of the batteries received proved to be faulty, and he had to return the money paid by his purchasers. Witness made a claim upon the vendors for £14,000; the proceedings extended over a period of two years, and he eventually received £8,500, which was exhausted in payment of outstanding debts, he having had recourse to moneylenders during the interval. His loss in the transaction was between £4,000 and £5,000. The debtor contended that he was more than solvent, and attributed his present position to his inability to collect moneys due to him for commissions earned and advances made; to loss over the electrical pocket batteries; and to stagnation of business during the 12 months preceding the date of the receiving order. The examination was concluded.

H. Garniss, electrician, late of 107, Beverley Road, Kingston-upon-Hull.—Receiving order made September 12th on debtor's own petition.

M. O. Heckels, electrical wholesaler and agent, 643, Welbeck Road, Walker, and Star Buildings, Northumberland Street, Newcastle-on-Tyne.—First meeting October 4th at the Official Receiver's offices, Newcastle-on-Tyne. Public examination October 19th at the County Court, Newcastle-on-Tyne.

Company Liquidations.—Saitax Manufacturing Co., Ltd.—Winding up voluntarily. Liquidator: Mr. W. Adams, 81, Albany Street, N.W.1. Meeting of creditors, September 25th.

Helsby Wireless Telegraph Co., Ltd.—A meeting of members is called for October 27th, at Surrey House, Embankment, W.C.2, to hear an account of the winding-up from the liquidator, Mr. J. B. Edwards.

Dissolutions of Partnership. — Tarbuck & Gilbert, plumbers, decorators and electrical engineers, 150, Broad Street, Chesham.—Mr. W. Tarbuck and Mr. G. Gilbert, jun., have dissolved partnership. Mr. Gilbert will attend to debts and continue the business.

Renshaw & Marsden, electrical engineers, 72, Penny Street, Blackburn.—Messrs J. Marsden, J. B. Renshaw and L. Marsden have dissolved partnership. Debts will be attended to by Mr. J. Marsden, who will continue the business under the same style.

Trade Announcements.—Mr. Frederick Pratt, 23, Queen Anne's Gate, S.W.1, has been appointed sales manager for the Midlands, South of England, and overseas, for the products of the Ironclad Switchgear Co., Ltd., Eccles.

Mr. H. Orgel, wholesale electrical factor, has recently transferred his business to 3, Bishopsgate Goods Station, Commercial Street, E.C.

Holophane, Ltd., informs us that the prices of its glassware and fittings have been reduced. The firm's new address is Elverton Street, Vincent Square, S.W.1.

"B. N. B." Wireless, Ltd., has opened new premises at 65, Renshaw Street, Liverpool.

Messrs. Jones Bros., electrical engineers and contractors, have opened showrooms at 53, Cardiff Road, Bargoed.

The Elco Electric Manufacturing Co., Ltd., has appointed Mr. H. S. Asbery, of 3, Paradise Square, Sheffield, as its sole agent in Yorkshire, and he will hold stocks of all materials at that address.

Messrs. T. J. Grainger & Co., Ltd., 31, Side, Newcastle-on-Tyne, have been appointed sole agents for the Northern counties for Messrs. Erskine, Heap & Co., Ltd., and Messrs. Elliott Bros. (London), Ltd.

Mr. W. W. Peck, who was for some years a director of Messrs. Mickelwright, Ltd., of Alperton, is starting business as the Vector Co., at 16, North Wharf, Gordon Road, West Ealing, London, W.13, and will make resistances, rheostats, dimmers, and regulating apparatus. Catalogues and lists are desired.

Early in 1920 the business of James Gordon & Co., Ltd., water-power engineers, was taken over by the English Electric Co., Ltd, and Mr. James Gordon was retained as manager of the water-power department. We learn that it has recently been arranged, on a mutually satisfactory basis, that the business of James Gordon & Co. shall in future be carried on as it was originally. Mr. Gordon notifies us that he is trading as "James Gordon & Co., Ltd."—an entirely independent concern—dealing, as heretofore, in water-power plant of all types and sizes. An illustrated leaflet, showing their turbines and governors, has been issued.

Mr. H. T. Barnett, M.I.E.E., will shortly be commencing business as an electrical and general engineer at 12, Whittington Chambers, King's Road, Portsmouth.

Mr. R. H. Dougan, who is shortly commencing business at 13, Davidson Road, Liverpool, specialising in the electrical equipment of ships, desires to receive catalogues of generating sets, switchgear and accessories.

The Midland Electric Light & Power Co., Ltd., is opening new offices and showrooms at 14, The Parade, Leamington, and desires to receive new catalogues.

Mr. A. F. Smith has opened premises as the Farnborough Electrical Co., at Farnborough, Hants. He asks for price lists, display cards, &c.

Catalogues and Lists.—Heavy Current Electric Accessories Co., Park Road, Edmonton, N.9.—A trade price list of "M.K." switch plugs and sockets, connectors, switches, &c.

Electrico, Ltd., 105, Old Christchurch Road, Bournemouth.—An illustrated booklet dealing with a variety of electrical devices, and a pamphlet advertising the "Ultra-Rapid" hand-driven drill and grinding machine.

Messrs. Phillips & Turner, 115, Edmund Street, Birmingham.—Illustrated lists of electric lighting fittings, &c.

British Electrical Repairs, Ltd., 2, Long Millgate, Manchester.—A booklet giving details of methods of repairing electrical machinery, with particulars of tests, and views of the firm's works.

The Electric Heating Co., 6, George Street, Croydon.—An illustrated card giving prices of electric fires; also an attached order card.

Engineering & Lighting Equipment Co., Ltd., Sphere Works, St. Albans, Herts.—Two well-illustrated leaflets dealing with street lighting fittings, including brackets, lanterns, anti-vibration disks, &c.

Messrs. Thomas & Stinchcomb, Narrow Wine Street, Bristol.—A priced and illustrated pamphlet describing the "Canorus" "wireless" tuner.

Messrs. Lionel Robinson & Co., 3, Staple Inn, W.C.1.—An illustrated and priced leaflet dealing with double-range voltmeters for wireless equipments. Also a pamphlet illustrating several examples of Western Electric "B.A.G." diffusers for use with gasfilled lamps. Priced.

The Tangent Tool Engineering Co., Ltd., 40-41, Great Marlborough Street, W.1.—An illustrated sheet describing shearing tools, punches, &c.

Messrs. William Sanders & Co., Falcon Electrical Works, Wednesbury.—An illustrated and priced pamphlet dealing with "Presto" ironclad switch and fuse-gear.

Mr. E. Mitchell, 119, Beckside Road, Lidget Green, Bradford.—An illustrated price-sheet of hand-made ornamental switch plates of various designs.

Messrs. Veritys, Ltd., 31, King Street, Covent Garden, W.C.2.—An illustrated and priced booklet dealing with "Maxlume" reflectors and lanterns.

Local Exhibition.—The Lancashire Electric Power Co. is holding an exhibition of electric lighting and domestic appliances from September 18th to 23rd, inclusive, at Ramsbottom. There have been demonstrations of electric ironing, cleaning, washing, sewing, heating, and lighting.

Annual Outing.—On Saturday, September 9th, the works and office staff of Premier Electric Heaters, Ltd., Birmingham, held their annual outing. The party motored to Evesham in charabancs, where the day began with a full sports programme in a field on the Avon-side, and boating on the river followed. Various places of interest in the town and district were visited. In the afternoon tea was served in the Public Hall, and at the conclusion the sports prizes were distributed.

The German Electrical Industry.—A German official report states that the reserve manifested in the demand for electrical manufactures in July was accentuated to some extent in August, particularly owing to the scarcity of money. Many schemes for central stations have been abandoned. On the other hand, business was satisfactory in glow lamps, railway safety appliances, and telegraph and telephone apparatus.

Book Notices.—"The Electrical Contractors' Year-book, 1922-23." (314 pp.). London: The Electrical Contractors' Association (Incorp.). Price 2s. 6d.—Every year this handbook increases in size, and this edition shows an accession of forty pages. A classified trade directory is one new feature of the 1922-23 Year-book, and this takes up a great deal of the new space. Another noticeable point is the largely-increased number of branches and sub-branches, there being 41, as compared with 28 in the previous edition. Other additions are the working agreement between the N.F.E.A. and the N.A.S.E., and the overtime, night-shift, and country allowance agreement of February 24th, 1921, and the rules and objects of the Electrical Trades Benevolent Institution. The president's report shows an increase in membership of the E.C.A. of 75, making 743; of the N.E.C.T.A. of 20, making 593; and of the N.F.E.A. of 49, making 743.

"The Brown, Boveri Review," August, 1922. London: Brown, Boveri & Co., Ltd.—The principal article in this issue is upon "Properties of Transformer Oils and their Behaviour when Heated"—a chemical treatise. The remainder of the space deals with "1,500-volt Rotary Converters for Direct-current Railways" and "Economic Advantages of Power-Factor Compensation by means of Phase Advancers."

Journal of the Institution of Electrical Engineers. Vol. LX. No. 311. July, 1922. London: E. & F. N. Spon, Ltd. Price 10s. 6d.—The following papers are contained in this issue:—"Electric-Farming, or the Applications of Electricity to Agriculture," by Mr. R. Borlase Matthews; "Protective Apparatus for Turbo-Generators," by Mr. J. Kuyser; "The Provision of Power for Wireless Telegraphy," by Major J. H. Whittaker-Swinton; and the address to the Western Centre by the president, Mr. J. S. Highfield.

Scientific Paper No. 443 of the U.S. Bureau of Standards. "Measurement of the Color Temperature of the More Efficient Artificial Light Sources by the Method of Rotatory Dispersion." (14 pp.). Washington: Government Printing Office. Price 5 cents.—This paper contains data on the colour temperature of the gasfilled tungsten lamp and the carbon arc.

We have received from Mr. N. C. Woodfin, A.M.I.E.E., Cape Technical Institute, South Africa, two useful leaflets. One is a diagram of a typical shunt motor starting switch, and the other is a list of fractional parts of an inch expressed in decimals. Both are primarily intended for the use of students.

"The Universal Directory of Railway Officials for 1922." London: The Directory Publishing Co., Ltd. Price 20s. net.

"Standard Handbook for Electrical Engineers." Fifth Edition. London: McGraw-Hill Publishing Co., Ltd. Price 30s. net.

"Science Abstracts," A. & B.; Vol. XXV, Part 8; August 31st, 1922. London: E. & F. N. Spon, Ltd. Price 2s. 6d. each net.

Trade with Belfast and Northern Ireland.—The following letter has been addressed by the President of the Belfast Chamber of Commerce to the principal chambers of commerce and railway companies in Great Britain:—

"Merchants in Belfast and district have recently received from manufacturers and merchants in various parts of Great Britain letters to the following effect: 'Owing to the unsettled state of Ireland we are now obliged to make the terms cash with order, &c.' They have also learned that officials of railway companies in Great Britain, on the pretext of 'the unsettled state of Ireland,' occasionally refuse to accept consignments of merchandise for Belfast and district. It is assumed that such action on the part of manufacturers and merchants and railway officials is due to ignorance of the actual state of things in Northern Ireland generally, and Belfast and district in particular. I, therefore, wish to point out that so far as Belfast and Northern Ireland are concerned, there is no valid excuse for the new impositions in the matter of terms, which unwarrantably reflect upon the credit of one of the thoroughly solvent parts of His Majesty's Empire, or for refusal on the part of carriers to accept consignments in the ordinary way. Business proceeds in Belfast and Northern Ireland as formerly, and the financial stability of the mercantile community remains intact: for instance, Belfast Corporation stock stands above par; Belfast fine trade bills can be negotiated at the minimum. The facts show that there is no greater risk in carrying merchandise from any part of Great Britain to Belfast and district than is experienced by the carrying companies in the daily conduct of their affairs in any part of Great Britain."

Christianity and Industry.—We are informed that a great deal of work has already been done in preparation for the Conference on Christian Politics, Economics, and Citizenship, which, with the official support of all the larger English churches, is to be held in the early part of 1924. The field of inquiry has been mapped out, and the results of the survey are now available in a series of questionnaires, purchasable for a few pence each from the secretary, Miss Lucy Gardner, 92, St. George's Square, S.W.1. These, and the replies to them, furnished by individuals and groups in all parts of the country, will be the basis of reports which will be placed in the hands of the delegates some time before the Conference meets. A preliminary meeting of those interested is to be held at the Queen's Hall on Thursday, October 26th, at 3 o'clock.

Cable Imports into Australia.—The British Trade Commissioner in Melbourne having reported that a number of cases have occurred in which insulated cable imported into Australia from British sources has been refused admission through non-compliance with the regulations of the Department of Customs, attention is drawn to the fact that the complete text of the regulations and tests governing the importation of rubber-covered wire and vulcanised rubber-insulated electric conductors may be seen at the Tariff Section of the Department of Overseas Trade, 35, Old Queen Street, Westminster, S.W.

Lantern Slides.—Messrs. E. Bennis & Co., Ltd., of 28, Victoria Street, London, S.W., wish it to be known that they have a large number of lantern slides available for lecture purposes. They cover mechanical stokers, and coal and ash elevating and conveying plant, and a booklet giving the titles and a brief description of the slides will be sent on application.

The English Electric Works at Coventry to be Temporarily Closed.—Our Coventry correspondent reports:—"Considerable regret has been occasioned at Coventry by the decision of the directors of the English Electric Co. to temporarily close their extensive works in the city with staff and workpeople numbering about 800, notices having been issued terminating their engagement. The workpeople have been given four weeks' notice and the staff eight weeks, the reason given being the general condition of trade and the unsettled state of Europe. It is intimated that the works will be started up again as soon as an increased volume of business justifies this step, and meanwhile every effort will be made to absorb at the company's other works as many of the Coventry employés as work can be found for. The other works referred to are at Preston, Bradford, Stafford, and Rugby. The English Electric Co. took over the Ordnance Works about three years ago and proceeded to utilise them for electrical productions. The Mayor of Coventry (Ald. W. H. Grant), in view of the large amount of unemployment already existing in the city, at once decided to get into touch with the directors of the company with the view of modifying the decision if possible."

Callender's (Leigh) Hospital and Distress Fund.—Presiding at the 11th annual meeting of members of the "Anchor" Cable Works Hospital and Distress Fund, held in the works canteen at Leigh on Monday, Mr. J. Bowyer (works manager) congratulated the employés on the fact that after having granted relief in sick and necessitous cases to the amount of £384 during the past year, they had still a balance in hand of £511. The officials of the fund had done excellent work during troublesome times and deserved the thanks of all concerned. The annual grants to charitable institutions sanctioned by the meeting amounted to £91 14s. and included £20 to the local infirmary, 21 guineas to the Manchester infirmary, and £15 to the Leigh After-Care Committee for Consumptive Cases. The following officers were re-elected for the ensuing year. President: Mr. Thomas Petersen (Callender's, London); trustees: Mr. J. Bowyer, J.P., and Mr. C. Hulme; hon. treasurer: Mr. William Mort; auditors: Mr. T. Kearsley and Mr. E. Rigby; secretary: Mr. W. Hulme Jones.

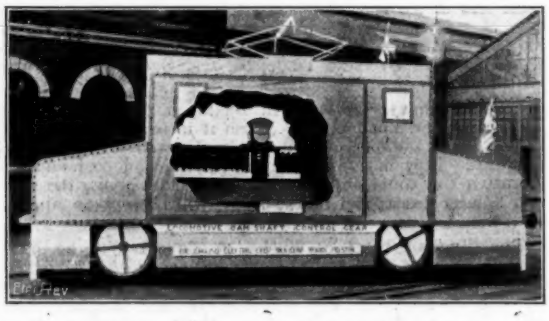
The Oversea Agency Problem.—The Federation of British Industries has on various occasions taken part in bringing about the formation of groups of non-competitive manufacturers to secure joint representation in foreign markets, on efficient and economical lines. The F.B.I. correspondent in Buenos Aires draws attention to the need for action of this nature in South America, where some of the largest British houses act also as agents for American goods to the detriment of British trade Groups should be formed into limited liability companies, the capital being provided by the member firms interested. This would permit of the maintenance of a large and attractive showroom and an adequate staff. Efficiency of management, together with increased sales, should result in the payment of a satisfactory dividend on the capital employed. The goodwill which usually reverts to the agent would be retained, and such a scheme should be more economical to work than the present methods.

The correspondent points out that previous experiments in this direction have failed because there was an overlapping between the different firms, and because they did not cover a sufficiently wide field.

Economics for Trade Unionists.—The National Alliance of Employers and Employed has arranged a course of lectures in economics and industrial history for members of trade unions. Mr. J. Drummond Smith, M.A., has been appointed lecturer, and the first lecture will be given at the London School of Economics and Political Science on Wednesday, September 27th.

Trade Marks in Latvia.—Under the Latvian Trade Marks Law registration is an essential condition of the protection of a trade mark. Among the information required is the full style and address of the individual or firm. Except by special permission of the Minister of Finance, trade-mark inscriptions must be in Lettish. The initial cost of registration is, at present, 860 Latvian roubles. The British Consulate at Riga is prepared to make applications for registration upon being provided with power of attorney.

Preston Guild Tableaux.—As briefly mentioned in our last issue, the English Electric Co., Ltd., had three cars in the recent Preston Guild procession. One bore operators carrying out processes in the manufacture of electric lamps; another was symbolical of the progress of light; and the



An "English Electric" Tableau at Preston.

third, which is seen in the accompanying illustration, was a model of an electric locomotive exhibiting the new English Electric camshaft control gear.

Applications for British Trade Marks.—Below is given a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries. Any firm desiring to enter an objection to any of the applications has one month in which to do so from the dates mentioned below. In the case of foreign firms, the address of the British representative to whom the objections must be sent is also given:—

Crown (design). No. 420,224. Class 8. Electric cables.—E. S. Co., Ltd., 233, Tottenham Court Road, London, W.1. September 13th, 1922.

Amplivox. No. 426,425. Class 8. Telephonic instruments.—The Sterling Telephone & Electric Co., Ltd., 210-212, Tottenham Court Road, London, W.1. September 13th, 1922.

Courtesy. No. 425,604. Class 8. Dimmer switches for use with electric light.—Marvulc Accessories Co., 43, Lamb's Conduit Street, London, W.C. September 13th, 1922.

Tex. No. 427,533. Class 8. Sparking plug testers.—John Hart, 12, Henrietta Street, London, W.C. September 13th, 1922.

Atea (lettering and design). No. 427,920. All goods in class 8.—The New Antwerp Telephone and Electrical Works, 22, Rue du Verger, Antwerp, Belgium (H. A. Gill & Co., 51-52, Chancery Lane, London, W.C.). September 13th, 1922.

Argental. No. 423,539. Class 13. Electric incandescent lamps (ordinary).—Naamlooze Venootschap Philips Gloelampenfabriek, Eindhoven, Holland (Boult, Wade & Tennant, 112, Hatton Garden, London, E.C.). September 13th, 1922.

Questa. No. 427,091. Class 13. Incandescent electric lamps (ordinary).—Francis H. J. Voak, 105-9, Oxford Street, London, W.C.2. September 6th, 1922.

Phonoelectric. No. 414,606. Class 5. Trolley wire.—Bridgeport Brass Co., 106, Crescent Avenue, Bridgeport, Conn., U.S.A. (White, Langner, Stevens & Parry, 88-89, Chancery Lane, London, W.C.). September 6th, 1922.

Mewco. No. 427,410. Class 5. All goods in Class 5.—Maidstone Electric Welding Co., Queen Anne Road, Maidstone. September 6th, 1922.

Rolac. No. 424,486. Class 6. Electric vacuum cleaners and electric washing machinery.—Société Calor, 200, Rue Boileau, Lyons, France (Herbert Haddan & Co., 31-2, Bedford Row, London, W.C.). September 6th, 1922.

AB. (lettering and design). No. 427,013. Class 6. Coal-cutting machines.—Anderson, Boyes & Co., Ltd., Flemington Electrical Works, Robberhall Street, Motherwell, N.B. September 6th, 1922.

Cecophone.—No. 427,617. Class 8. Appliances for wireless telephony.—General Electric Co., Ltd., Magnet House, Kingsway, London, W.C. September 6th, 1922.

Vio Ray, Violet Ray High-frequency Electricity (lettering and design). No. 425,693. Class 11. Instruments, apparatus, and contrivances, not medicated, for use with, or in the production of high-frequency violet rays for surgical or curative purposes.—Vio-Ray Electric Co., Ltd., 114, Charing Cross Road, London, W.C. September 6th, 1922.

Elexitis. No. 425,359. Class 13. Electrical connecting and supporting devices, switches, &c.—Electric Outlet Co., 8, West 40th Street, New York, U.S.A. (Marks & Clerk, 57-8, Lincoln's Inn Fields, London, W.C.). September 6th, 1922.

Calphos. No. 425,917. Class 13. Electric lamps and accessories therefor.—The Calphos Electrical Co., Ltd., 66, Victoria Street, Westminster, S.W. September 6th, 1922.

AT (lettering and design). No. 425,959. Class 13. Electric lamps (ordinary) and accessories thereto.—Pope's Metaaldraadlampenfabriek, Venlo, Holland (Marks & Clerk, 57-8, Lincoln's Inn Fields, London, W.C.). September 6th, 1922.

FAP. No. 425,921. Class 13. Electric conduits and fittings.—Fitter & Poulton, St. John's Engineering Works, Weston Lane, Greet, Birmingham. September 6th, 1922.

Unemployment.—The Ministry of Labour returns for the week ended September 4th recorded a total of 1,328,000 unemployed persons—a decrease of about 3,400 on the previous week's total. Since the beginning of the year the total has been reduced by about half-a-million. There was also a decrease of 2,000 to 61,500 in the number of workers on "short time."

The highest number of unemployed persons occurred in June, 1921, when the total was 2,044,655.

Marking Goods for India.—The importance of marking clearly all British non-proprietary goods shipped to India is emphasised in a recent communication from the F.B.I. correspondent at Calcutta. In order that Indian stockholders may be able to assure their buyers that they are being offered articles imported from Britain, he suggests that the goods in question should be marked neatly and distinctly "Made in England," "Made in Sheffield," "London Make," or with some such appropriate phrase indicating their origin. Goods which are not so marked may be mistaken for those of Indian or Japanese manufacture.—F.B.I. *Bulletin.*

Australian Working Hours.—The Arbitration Court has dismissed claims put forward by the Timber Workers and Amalgamated Engineers for recognition of a 44-hour standard working week. The President of the Court said that industry could not be expected to bear the increased cost of production. The Court rejected a similar plaint in December last. That claim and the one now dismissed are regarded as test cases for all the unions of the Commonwealth.—*Reuter* (Melbourne).

Vulcanised Fibre Inquiry.—A Board of Trade Committee, under the chairmanship of Sir Bernard Mallet, made an inquiry on September 12th into a complaint made by the B.E.A.M.A. (on behalf of Messrs. Sutcliffe, Crumpsall, Manchester) that American vulcanised fibre was being sold in this country at a price below the British production cost. The Electrical Importers' & Traders' Association appeared against the complaint. Mr. Swan, for complainants, said the agreed selling price for foreign vulcanised fibre for mechanical and electrical purposes was 1s. 7d. per lb., but it was only necessary to state that the fibre was for export purposes to evade the agreement and sell it at a lower price. Major Entwistle, for the opposers, said that it was unprecedented for an Act of Parliament to be invoked for the benefit of one individual. Protection would give the complainant's firm an absolute monopoly. After the taking of further evidence the inquiry was concluded.

A Large Cooking Installation.—The White Star Co. has shown its faith in the efficacy of electric cooking by installing in its liner *Pittsburgh* what must be one of the largest electric

Carron Range on the "Pittsburgh."

cooking installations yet erected. This was supplied by Carron Company, and the central galley range is seen in the accompanying illustration.

Lamp Competition in Italy.—The directors of the S.A. l'Incandescence par le Gaz Auer en Italie, reporting on the past year, recall the fact that by arrangement with a Spanish firm the latter had installed a glow-lamp factory in the former's works in Milan, and had given the company the right of selling the production in Italy. But in this respect the company, owing to the absence of import duties, is subject to the keen competition of German and Austrian makers, which has forced down the sale prices of glow lamps in Italy to a level which yields no profits. It had been hoped that import duties would be established, but nothing in this direction has been done down to the present time.

Wages in the Tramway Industry.—A national delegate conference of the Transport & General Workers' Union was held on September 19th, and delegates reported the attitude of their branches towards the proposed abolition of the sliding scale, and the reduction of wages by 12s. a week, in three instalments. The branches had unanimously agreed that all necessary action should be taken to prevent the employers' proposals going forward.

The decision of the conference was placed before a meeting of the National Joint Industrial Council for the Tramways Industry on the following day (Wednesday).

Sunderland Town Council, on the recommendation of its Tramway Committee, last week decided to forthwith cease to recognise the National Joint Industrial Council for the Tramway Industry and to give notice of withdrawal. Ald. New (Chairman of the Committee) said he was not in favour of a sudden reduction of 12s. per week in wages, but the undertaking could not go on paying the scale now in force. Terms were best settled locally, and until they came to an agreement with the men they would continue to recognise the terms of the Industrial Council.

British Train Traders, Ltd.—A company has been registered under the above style with the object of running specially-designed train coaches and aircraft for the exhibition of samples of manufactured goods, after the fashion of the British Trade Ship. The scheme has many advantages, and may meet the needs of manufacturers and dealers better than the usual methods of displaying their wares. The company has issued a booklet describing its aims, and dealing more particularly with its initial project, the running of a train through Canada. The address of the company is Canada House, 42, Blackfriars Road, S.E.1.

New Burnley Kinema.—The new Grand Kinema Hall at Burnley was opened this week. The electric lighting has been carried out by Messrs. J. Walton & Sons, of Nelson. The Sturtevant Co. has installed a new type of vacuum cleaning plant.

American Purchases of German Bonds.—Some astonishment has been created lately in Berlin by the extraordinary rise in the bonds (debentures) of the A.E.G. It turns out that the advance in quotations was due to purchases made for American account, investors in the United States having a preference for just a few German industrial securities, of which the A.E.G. represents one.

Australian Import Duties.—The House of Representatives has agreed to certain Budget tariff amendments relating to wire netting and fencing wire, galvanised iron, and traction engines. The following addition has also been agreed to:—Alternating-current watt-hour meters: 35 per cent., preferential; 40 per cent., intermediate; 45 per cent., general.—*Reuter's Trade Service* (Melbourne).

Jugo-Slavia.—It is reported that the Société Italienne pour le Carbure has disposed of its shares in the Société des Forces Hydrauliques de la Dalmatie (Kerka) to an English syndicate which is understood to be representing a Jugo-Slav group. The change has probably been brought about by the fact that the works are located in that part of Dalmatie which, since the signing of the Peace treaty, has become Jugo-Slav territory.

For Sale.—By direction of the Disposal Board, offers are invited for part of the electrical generating plant at H.M. factory, Gretna. (See our advertisement pages to-day.)

LIGHTING AND POWER NOTES.

Ayr.—Price Reductions.—In view of a credit balance of £11,738 upon the past year's working of the electricity undertaking, the Town Council has reduced the charges for electricity to pre-war rates, plus 25 per cent.

Bishop's Castle.—Street Lighting.—The Town Council has accepted the tender of the Electric Light Co. at £100 for the lighting of the streets. The agreement is for three years.

Bradford.—Loans Sanctioned.—Formal sanction has been obtained from the Electricity Commissioners by the Corporation to the borrowing of the following amounts for electricity extensions:—Buttershaw electricity supply, £5,500 (on account) for mains; Wyke, £3,250 (on account) for mains; and £1,100 (on account) for transformer chamber, &c.

Lighting Economy.—It is reported that a saving of between £20,000 and £30,000 has been effected during the past summer by reduced street lighting. Before the war there was practically no distinction between winter and summer street lighting.

Bo'ness.—Future of Undertaking—The Town Council's agreement with the National Electric Construction Co. expires shortly, which makes it necessary to decide whether the town will carry on the electricity works as a municipal undertaking, or arrange with the company to take it over as a purely private concern. The company has already indicated that it is willing to take over the works, subject to suitable terms being arranged.

Burton-on-Trent.—Plant Extensions.—The Borough Council has received the sanction of the Electricity Commissioners to the installation of one 6,000-kW turbo-alternator and two 40,000-lb. boilers. Sanction has also been given to the borrowing of £104,111 for electricity purposes.

Price Reductions.—The Electricity Committee has recommended the following reductions in the charges for electricity:—Lighting: Flat rate from 7½d. to 7d. per kWh; outside shop lighting, 7½d. to 7d. per kWh; electric picture palaces, 5½d. to 5d. per kWh. Heating and cooking: 1½d. to 1¼d. per kWh. Power: A reduction of 16⅔ per cent., except to consumers with agreements. Tramways: 2d. per kWh as from the March, 1922, readings.

Canada.—Hydro-Electric Development.—The Hull Electric Co. has acquired the Paugan Falls of the Gatineau River, together with the necessary property adjacent thereto, for the purpose of hydro-electric development on a large scale. A dam will be constructed which will create a reservoir ten square miles in area. The ultimate development contemplated is 150,000 h.p., and the cost is estimated at ten million dollars. The falls are situate 35 miles from Ottawa, which is at present dependent upon the Chaudière Falls for the 50,000 h.p. of electric energy employed.—*Reuter's Trade Service* (Ottawa).

Cannock.—Application for Order.—The Urban District Council has decided to apply to the Electricity Commissioners for a Special Order under the Electricity (Supply) Acts, 1882 to 1922, for the purpose of extending the area of supply of the Council so as to include parts of the urban district of Brownhills, the whole of the Rugeley urban district, the whole of the parishes of Brereton, Hatherton, Huntington, and Cheslyn Hay, and parts of the parishes of Great Wyrley and Penkridge. At the same time the Rugeley Urban Council has decided to apply for an electric lighting Order, and the Cannock Council is to be informed of Rugeley's application.

Chatham.—Price Reductions.—The charges for electricity are being reduced by ¼d. per kWh for lighting and ¼d. per kWh for heating.

Clayton.—Projected Supply from Bradford.—Subject to necessary consent being obtained, and to the sanction of the Commissioners to the requisite borrowing powers, Bradford Electricity Committee has agreed to extend its electricity supply services to Clayton, but in view of the recent defeat of the City Extension Bill in Parliament, the Corporation is not prepared to make any definite statement at present as to the incorporation of Clayton, which was one of the few out-districts which desired to be absorbed.

Continental.—Belgium.—His Majesty's Consul at Liége reports that, according to information published in the local Press, the project for the distribution of electrical energy throughout the province of Liége has been referred back for further examination in view of the present financial state of the province, which shows a deficit of over 2,000,000 fr.

Dundalk.—Raid on Station.—On September 14th a band of armed men broke into the power station, Chapel Lane, held up the staff, and compelled the engineers to cut off the lighting.

Horwich.—Proposed Electricity Supply.—Mr. Wood, Bolton's electrical engineer, attended a meeting of Horwich District Council with a scheme for the supply of electricity in the district. The Council is applying to the Electricity Commissioners for a Special Order authorising it to generate or purchase electricity in bulk and distribute it within the boundaries of the urban district.

Holmfirth.—Price Reduction.—The Urban District Council has decided to reduce the price of electricity for lighting purposes from 9d. to 8d. per kWh.

Kirkwall.—Proposed Electricity Scheme.—An electricity scheme for the burgh is proposed, and the Town Council is to approach the Electricity Commissioners upon the subject.

Knaresborough.—Proposed Water-power Scheme.—The Council has in hand a scheme for generating electricity by the use of the water-power of a mill weir on the River Nidd.

Lampeter.—Permission to Supply Refused.—The Town Council has refused to give consent to the application of Mr. William Jones for an electric lighting Order on the ground that he would have a monopoly of electricity supply in the borough.

Llandrindod Wells.—Purchase of Electricity Undertaking.—It was reported at a recent meeting of the Urban District Council that the Electric Lighting Co. was willing to enter into a provisional agreement for the sale of its undertaking to the Council for the sum of £22,500, plus £750 for the adjoining property. The Council's technical adviser (Mr. J. W. Burr) is preparing detailed particulars, with a view to ascertaining from the Electricity Commissioners the terms upon which the necessary loan would be granted.

London.—St. Pancras.—*Extensions.*—Subject to the consent of the Electricity Commissioners, the Borough Council is to make the following additions and extensions at the King's Road station:—Two large boilers, £30,000; extension of boiler-house, steelwork, &c., £10,000; switchgear, £3,000; and one 5,000-kW turbo-generator, including pipework, foundations, &c., £39,000; total estimated cost, £82,000.

Price Reductions.—The Electricity and Public Lighting Committee reports that, maintaining the present rates, the estimated profit for the current year would be £42,000. The Committee therefore recommends the following reductions in charges:—Power and heating, from 1½d. to 1d. per kWh; lighting (flat rate), from 6d. to 5d. per kWh; and street lighting, from 3d. to 2½d. per kwh. These reductions, it is anticipated, will reduce the year's profit to £18,000.

Mains Extensions.—The Committee recommends the installation of a new high-pressure cable and distributing mains at an estimated cost of £4,500.

Stoke Newington.—*Price Reduction.*—The Electric Lighting Committee recommends a reduction of ½d. per kWh in the charges for electricity for lighting, heating, and power.

Purchase of Cookers.—The Committee proposes to purchase ten electric cookers at a cost of £12 6s. each, to be re-sold on a hire-purchase system. It is also proposed to buy, at a cost of £130, a cooker suitable for providing for 90 persons. This will be installed at the premises of the Female Guardian Society, and the latter body will repay the cost at the rate of £25 per year for seven years.

Fulham.—*Loans Sanctioned.*—The Borough Council has received the sanction of the Electricity Commissioners to borrow the following amounts:—Mains and services (including £6,000 for unspecified extensions of mains), £15,896; and for transformers and switchgear, £4,252; total, £20,148.

Mains Extension.—£3,000 is being spent upon a cable from the Waterford Road sub-station to FitzGeorge Avenue, subject to the approval of the Electricity Commissioners.

Shoreditch.—*Price Reductions.*—The Lighting Committee has drawn up a schedule of reduced prices which it is proposed shall have effect as from the present month's meter readings. The following are the principal charges:—Lighting: Maximum demand rate, 7d per kWh for the first 1½ hours, 3½d. thereafter; flat rate, 6d. per kWh; theatres and music-halls, 5d.; outside lighting (signs and arc lamps), 4d.; factory lighting from 3.5d. to 5d. per kWh, according to consumption; electrical showrooms—energy for trade and testing purposes—4d. Heating: 1½d. per kWh. Cooking: 1½d. per kWh. Power: Maximum demand system, 20s. per quarter per electrical h.p., plus 1.25d. per kWh. (A special scale of discounts is also included in this portion of the schedule); maximum price, 10 per cent. load factor, 2.5d. per kWh, less than 10 per cent. load factor, 3d. per kWh.

Hire of Appliances.—A scale of quarterly charges has been fixed for the hiring-out of electrical appliances by the Borough Council. The charge for cookers ranges from 8s. 6d. per quarter for cookers valued at £10, to 32s. for those costing £40. Electric radiators will be charged for as follows:—1-kW, 2s. 6d.; 2-kW, 3s. 6d.; and 3-kW, 4s. The charge for electric kettles (3-pt. size) will be 2s. 6d., including maintenance, or 1s. not including maintenance.

Installation of Feeder.—The Borough Council is seeking sanction to expend the sum of £1,431 upon the laying of a feeder main to the works of the Aston Construction Co., Ltd.

Hammersmith.—*Year's Working.*—The accounts for the year ended March 31st last of the electricity undertaking record a total income of £182,717, as compared with £178,349 in the previous year. The expenditure upon revenue account amounted to £129,908, as against £143,494, leaving a gross profit of £52,808 (£34,855). Interest, sinking-fund charges, &c., absorbed £37,694 (£29,221), making the net result a profit of £15,114, considerably more than the preceding year's profit —£5,633. There was a slight decrease in the amount of energy sold—from 15,497,826 to 15,262,130 kWh, but the average price obtained per kWh rose from 2.64d. to 2.76d.

In his report, the engineer (Mr. G. G. Bell) said that the fuel consumption had been improved from 4.08 to 3.81 lb. per kWh generated; one boiler had been operating on powdered fuel. During the year £130,440 had been expended on capital account. Of this £65,000 was in connection with the two new 10,000-kW sets, and mains, services, and transformers cost about £65,000.

Mansfield.—Application for Order.—The Town Council has applied to the Electricity Commissioners for an Order authorising it to supply electricity in the urban districts of Sutton-in-Ashfield and Huthwaite.

Montrose.—Public Lighting.—The Town Council has accepted the offer of the North of Scotland Electric Light and Power Co., Ltd., of £875 per annum for a period of three years, for the public lighting of the town.

North Wales.—Bulk Supply Agreement.—The draft agreement with the Bangor Corporation for the supply of electricity in bulk has been considered by the Menai Bridge Urban Council and confirmed. It was explained that the cable would be laid by the Bangor Corporation midway across the Suspension Bridge. The Menai Bridge Council would pay towards the capital charges and would also put up a transformer station in its own premises. The charge for each kWh in excess of 20,000 kWh would be 1½d. The guaranteed minimum demand was for 20,000 kWh. Roughly, the consumption at present was 16,000 or 17,000 kWh, but there was every reason to think that additional houses would be wired.

Cowlyd Dam.—On Wednesday the new Cowlyd Dam, which has been constructed by the Aluminium Corporation, Ltd. (in association with the North Wales Power Co., Ltd.), at a cost of over £200,000, was formally opened by Sir John Snell, in the presence of a large number of spectators interested in electrical matters throughout the North Wales and Chester Electricity District.

Northern Ireland.—The *Financial Times'* Belfast correspondent reports that a syndicate has been formed to carry out a hydro-electric scheme employing the Lower Bann River above Coleraine. It is calculated that an annual output of 30,000,000 kWh is obtainable, and it is hoped to supply not only the adjacent industrial towns of Coleraine, Ballymoney, Antrim, and Ballymena, but also to transmit a substantial surplus to Belfast, 35 miles away. A Bill is to be promoted for the purpose in the next session of the Northern Ireland Parliament, and it is stated that the necessary funds are already available.

Oldham.—Price Reductions.—The Electricity Department of the Town Council has reduced the price of energy for lighting and power purposes as follows, with effect from September 26th:—Cotton mill supplies: Increase of 20 per cent. to be discontinued; power (other than cotton mills), increase to be reduced from 75 per cent. to 55 per cent.; lighting, increase to be reduced by 10 per cent., making the increase over pre-war prices approximately 65 per cent. The flat-rate charge for lighting is to be 4½d. per unit. In the case of two-rate meters, the high rate is to be charged from 4 p.m. to 8 p.m., instead of from 6 p.m. to 10 p.m.

Portsmouth.—Pumping Plant Supply.—The Town Council is applying to the Electricity Commissioners for sanction to a loan of £10,000 for new main transmission lines from the generating station, in order to supply electricity for the pumping plant in connection with a new drainage scheme.

Rothesay.—Electricity Supply.—The Town Council is inquiring of the Rothesay Tramway Co. regarding a supply of electricity to the burgh.

Seaton.—Electricity Supply Scheme.—A committee has been formed for the purpose of carrying out an electric lighting scheme submitted by Mr. Royce, of Bristol. It is proposed to form a local company with a capital of about £8,000.

Staines.—Special Order.—The Electricity Commissioners have made a Special Order authorising the Egham and Staines Electricity Co., Ltd., to supply electricity in the parishes of Ashford, Stanwell, Wraysbury, and Thorpe.

Straits Settlements.—Penang.—The Municipality of Penang is negotiating for the construction of a large power station on the Prai wharves, from which Penang will be supplied by means of submarine cables. The station has been designed for an ultimate capacity of 135,000 h.p., and will be capable of dealing with the whole of Penang, Province Wellesley, and possibly parts of Kedah. There will be electric cranes, &c., at the Prai wharves, and the tramway system is being converted for railless electric cars.—*Reuter's Trade Service* (Singapore.

Stirling.—Year's Working.—The accounts of the municipal electricity undertaking (engineer: Mr. W. R. Murray) record a revenue, during the year ended May 15th last, of £15,514, and working expenses of £10,138, leaving a gross profit of £5,376. To this was added a profit of £4 from the hiring of motors. Capital charges absorbed £3,685, and the net profit, transferred to reserve, was £1,695. The energy sold was 685,291 kWh, as compared with 683,903 kWh in the previous year.

Sunderland.—Extensions.—The Town Council has adopted the following proposals of the Electricity Committee:—The provision of additional switchgear at Dunning Street sub-station, estimated cost, £627; the erection of an open-type sub-station at Hendon Dock, with necessary mains equipment, £2,301; the extension of mains in certain streets, £2,164; and repairs to the roof of Hylton Road works, £1,094.

Walsall.—Extension of Supply.—The Town Council is applying to the Electricity Commissioners for a Special Order authorising it to supply electricity within various adjoining areas, and also for sanction to borrow £2,000 for mains and switchgear.

Western Highlands.—The Lochaber Scheme Delayed.—The British Aluminium Co. is to delay proceeding with the Lochaber hydro-electrical scheme until costs are reduced. The company's Act allows it five years in which to make a commencement of the work.

Wickford.—Electricity Supply.—The Wickford and District Supply Co., Ltd., has applied to the Electricity Commissioners for consent to establish a generating station on the Beeches estate.

Yeovil.—Extension of Time Approved.—The Town Council has approved of a final extension of six months being granted to Petters, Ltd., for carrying out the works under its electric lighting Order.

TRAMWAY AND RAILWAY NOTES.

Canada.—MONTREAL HARBOUR RAILWAY ELECTRIFICATION.—Electrification of the Harbour railway terminals, with a total length of 58 miles, is proceeding, and it is expected that by the end of September 42 miles will have been electrified. The remaining 16 miles will probably be completed next season, according to a statement issued by Mr. M. P. Fennell, manager of the Montreal Harbour Commission. Electric locomotives of a type especially suited for harbour work will be purchased by the Commission.—*Reuter's Trade Service* (Montreal).

Chile.—RAILWAY ELECTRIFICATION.—The Chilean Government's policy is to electrify the whole of the broad-gauge railways under its control—over 3,000 miles. It has been considered that the 3,000-V d.c. system is most suitable, having regard to the conditions, and practically the whole of the necessary power will be derived from hydro-electric resources. The contract for the first part of the scheme—the electrifying of the Valparaiso-Chile lines, a distance of 116 miles—went to America, the British tenders having been considerably undercut. Apart from the State railways there is about 1,500 miles of privately-owned track, and the electrification of much of this is being considered.

Dundee.—NEW TROLLEY DEVICE.—The Corporation Tramways Committee recently witnessed a demonstration of a new safety device invented by a young Leith mechanic for the preventing of trolley heads from falling off. The device is simple in design and the cost is comparatively small. The inventor was congratulated and a recommendation will be made to have the new apparatus installed on all the department's cars.

Falkirk.—PROJECTED IMPROVEMENTS—Representations as to the unsatisfactory condition of the track between Falkirk and Laurieston having been made to the Falkirk and District Tramways Co. by the Eastern District Committee of the Stirling C.C., the company has intimated that three schemes are under consideration, *viz.*, the renewal of the track with concrete foundations, at an estimated cost of £14,000-£16,000; the relaying of the line on sleepers; or the abandonment of the tramway, substituting therefor a railless vehicle service. The committee decided to send a deputation to interview the company, and a report is to be presented at the next meeting.

Glasgow.—PROPOSED EXTENSIONS.—The extension of the tramways from Clarence Drive to Great Western Road, and the introduction of a railless trolley car service from Clarkston to Eaglesham, are proposals under consideration by the Corporation.

L. & N.W. Railway.—ELECTRIFICATION.—A new cable is being laid along the eastern side of the Liverpool, Waterloo and Southport line of the L. & N.W. Railway. It is understood to be the intention of the management to add to the high-pressure power, and thus enable it to lengthen the trains, which rarely exceed five coaches. By adding one or two more coaches to each train during the business hours much congestion and strap-hanging will be avoided.

Leicester.—YEAR'S WORKING.—The report on the working of the tramway undertaking for the past year shows a deficit of £20,000.

London.—LATE "UNDERGROUND" TRAINS.—In reply to questions raised in certain daily papers the "Underground companies have issued a statement showing that the last trains from busy traffic centres leave at about 12.30 a.m. Later trains have been tried, but the traffic was so small as to preclude their continuance. The first trains commence running as early as 4.45 a.m., and as the last train does not cease running until 1.14 a.m., only 3¼ hours is available in which to carry out inspection and overhauling.

CITY AND SOUTH LONDON RAILWAY.—A two-minute service is now being operated during the "rush hours" on the line between Clapham Common and Moorgate.

Newcastle-on-Tyne.—NEW ROUTE.—A scheme is in hand for laying a double tramway track across the High Level bridge, which will connect up Newcastle with Gateshead. The scheme will necessitate considerable reconstruction of the bridge, the estimated total cost being £22,000, of which the Corporation will bear six-elevenths. The North-Eastern Railway Co. is to carry out the work, and will receive ½d. per passenger from the receipts. This connecting link will give a direct tramway route of six miles from Gosforth Park to Low Fell.

South Shields.—NEW ROUTE.—With the object of providing work for the unemployed the Tramways Committee has submitted a scheme to the Unemployed Grants Committee for laying down a track so as to make a connecting route from the pier head to Westoe *via* the sea front.

TELEGRAPH AND TELEPHONE NOTES.

Atlantic Cables.—The cable from Ballinskelligs, Ireland, to Harbour Grace (Newfoundland) and Halifax was taken over recently by the Imperial Cable from the Western Union Cable Co. The British Government purchased the cable in November, 1920, for £750,000, but it had remained under Western Union control by lease. The cable taken over was laid in 1874, and was the first transatlantic cable to use the Muirhead duplex system. Its first Nova Scotia landing place was at Torbay, Guysboro' county, but it was moved to Halifax in 1887.—*Electrical News.*

Brazil.—TELEPHONE RATES.—At last the Brazilian Traction Co. has obtained a revision of the concession regulating the telephone service of the City of Rio de Janeiro, in which it is largely interested. The old contract was apparently quite inapplicable to present-day conditions, especially having regard to currency depreciation. A new contract has been signed, under which rates will vary with the exchange, and other onerous conditions are eliminated. The new rates, it is stated, are calculated to afford an adequate return to present and future capital investments, and are subject to revision every five years. Brazil Traction shares have been much in favour of late, and from the lowest of 31 touched at one time this year the price has risen to 53.—*Evening News.*

Cuba.—WIRELESS TELEPHONY.—An increasing interest is being taken in Cuba in radio-telegraphy and telephony, with the result that considerable orders for apparatus are being placed. It is intended to install a broadcasting station powerful enough to be heard in every town in the Oriente Province. Hitherto, little but amateur work had been employed in connection with the receiving stations in use, the necessary parts having been obtained from abroad and assembled on the spot. Lately, owing to the increased demand for apparatus and accessories, local stocks have been considerably depleted. The proximity of Cuba to the broadcasting facilities afforded by the United States has increased the possibilities for developing a market there for other radio sets.—*Reuter's Trade Service.*

Germany.—INCREASED TARIFFS.—The Reichsrat has approved the new postal tariff by which the postal, telegraph, and telephone fees will be considerably raised. In spite of the large increases, the Minister of Posts declares that there will be a deficiency of from fifteen to twenty milliard marks in the budget for posts and telegraphs. The Reichstag has still to give its approval to the proposed increases.—*Reuter* (Berlin).

Holland.—ILLEGAL WIRELESS TRANSMISSION.—A member of a Dutch banking firm is being proceeded against for sending wireless code messages to London with reference to Stock Exchange transactions. These messages were principally concerned with oil shares. Although the firm had three receiving stations for wireless messages it had been unable to obtain permission from the Dutch Government for the sending of wireless messages to London. The defendant is alleged, therefore, to have bribed a young wireless operator in the Dutch army to send the messages, thus infringing the law. This operator will be court-martialled.—*Daily Mail.*

Ireland.—POSTAL STRIKE.—The strike of the Post Office workers in the South of Ireland has resulted in almost a complete paralysis of business. The Belfast telegraphists recently addressed a most indignant protest to the Union of Post Office Workers against having Press and private messages from the South of Ireland sent to England and elsewhere *via* Belfast. The Post Office authorities have replied to the Union that the matter complained of will have consideration. The strike is generally confined to postal workers, the telegraphists not being affected, but in some parts they have been interfered with.

Jersey.—PURCHASE OF TELEPHONE SYSTEM.—The Jersey States have decided to accept the offer of the postal authorities to sell the telephone system, they agreeing to pay £32,032 and take over all liabilities.—*The Times.*

New Zealand.—PROPOSED WIRELESS STATION.—Mr. J. G. Coates (the Postmaster-General) has informed Parliament that the Government is considering the establishment of a high-power wireless station. It has not yet been decided whether New Zealand will have a system directly communicating with Great Britain or whether it will form a link in the Empire wireless chain.—*Reuter* (Wellington).

Norway.—WIRELESS TELEPHONY.—Mr. Engset, director of the State Telegraph Administration at Christiania, is reported to have stated that the Norwegian Government has reserved the right to utilise both wireless telephony and telegraphy in that country. A year ago the Marconi Co. carried out wireless telephone experiments between the West of Norway and England, which were satisfactory, and similar trials were recently made by the telegraph administration between Kristiansund and Grip. It is proposed to erect a new wireless station at Trondhjem of similar capacity to that at Rundemanden, and also to equip it for telephony. It will be necessary to reconstruct for the same purpose at Runde-

manden and at all the coastal stations, as, for instance, those at Flekkero, Tjomo and Utsire. Mr. Hermod Petersen, one of the State engineers, has been dispatched to England further to investigate the problem in the light of the experience already gained there.

River Plate.—Underground Cables—It is reported from Bahia Blanca that the United River Plate Telephone Co., with the object of improving the service there, intends to replace the overhead wires by underground cables, and that it has already received 58,000 kilos. of cable for this purpose.—*Review of the River Plate.*

Russia.—Wireless Telegraphy.—A Moscow message says that the Central Radio Telephone Station at Moscow has succeeded in communicating quite distinctly with Obdorsk, a town in the Arctic region of Western Siberia, a distance of over 1,250 miles.—*Central News* (Copenhagen).

The Telephone Service.—New Exchange.—A new exchange was opened on September 16th at Inverness. A central-battery switchboard with the necessary auxiliary equipment has been installed at the post office in Queensgate to take the place of the magneto equipment at the present exchange in Union Street, which has served the town for about 20 years, and is now inadequate for the growing telephonic requirements of Inverness and district. The new exchange is fitted for the accommodation of 780 subscribers' lines, as compared with 450 lines at the present exchange, and is constructed so that its capacity may be readily increased up to 1,500 lines. The post office building has been enlarged to accommodate the equipment.—*Financial Times.*

Uruguay.—Wireless Telegraphy.—It is announced that a decree will shortly be issued regulating the installation of radiotelegraphic and radiotelephonic stations in Uruguay. Such stations, it is stated, will be permitted anywhere except at points where State stations exist, provided that they are not within 50 kilometres of the sea coast or of the Argentine and Brazilian frontiers, and that they are not installed in important cities or towns.—*Review of the River Plate.*

Wireless Telephony.—Weather Forecasts.—An interesting announcement concerning the distribution of weather forecasts was made by Dr. G. C. Simpson, the director of the Meterological Office, at a meeting of the Mathematical and Physical Science Section of the British Association at Hull. It was stated that the present distribution by wireless telegraphy was made in the Morse code, and one speaker suggested that he was too old to begin to learn Morse. He asked why information could not be sent out by wireless telephony. Dr. Simpson said a scheme of this nature had already been prepared with details worked out for distributing the "general inference" by wireless telephone as soon as there was an organised scheme for broadcasting in this country. When such broadcasting was authorised the Meteorological Office would be able at once to issue forecasts in this way.—*Daily Telegraph.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Sydney.—October 23rd. Minister of Public Works. Two water-turbines and generators in connection with the Barren Jack hydro-electric development (September 8th.)

Adelaide, South Australia.—December 5th. Adelaide Electric Supply Co., Ltd. 380 electric motors.

Melbourne.—January 31st. Victorian Electricity Commissioners. Back pressure steam turbine, including one 1,500-kW turbo-alternator (Spec. 308), four water-tube boilers and accessories (Spec. 317). (See this issue.)

Belfast. — September 26th. Tramways Committee. Tramway stores, including electrical accessories, cable, lamps, &c., for five months. (September 8th.)

Belgium.—October 12th. The municipal authorities of Quaedmechelen (Province of Limburg). Concession for the establishment of a system of electricity distribution in the town.

Brazil.—Cachoeira, Rio Grande do Sul.—October 24th. Municipal Council. Six centrifugal pumps, with electric motors, piping, &c.*

Cardiff.—September 26th. Glamorgan Education Committee. Installing electric light in County schools. Secretary, Education Committee, County Hall, Cardiff.

Ebbw Vale.—September 27th. Electricity Department. Three 300-kW rotary converters, transformers, switchgear, &c.; 1,250 yd. 500-V, d.c., .5 x .2 x .5 cable. (September 15th.)

Egypt.—Cairo.—September 30th. Electric pump, accumulator plates, and a 3-phase transformer, for the Asite des Aliénés, Khanka. Engineer-Electrician-in-Chief, Electrical Service, Ministry of Public Works, Cairo.

November 15th. Installation work in connection with a power station and distribution system at Manfalout. Director of Technical Service, Section of Municipalities and Local Commissions, Savoy House, Cairo.—*Reuter's Trade Service* (Cairo).

Hawarden.—October 4th. Board of Guardians. Supply and erection of an electric generating set, and also for wiring for electric lighting the Institution at Broughton. (See this issue.)

Loughborough.—September 29th. Electricity Department. Rotary converter plant; sub-station switchgear. (September 15th.)

New Zealand.—Auckland.—February 1st, 1923. Harbour Board. One 1-ton fixed electric crane.*

Invercargill.—December 15th. Southland Electric Power Board. Turbines and valves, generators, exciters, and battery equipment, steel penstocks and valves, switchboards, switchgear and cables, for the Monswai hydro-electric development scheme. Mr. W. Hinchey, chairman, Southland Electric Power Board, P.O. Box 121, Invercargill, N.Z.

Wellington.—November 21st. Public Works Department. Mangahao scheme. Electrical storage battery and accessories, including a motor-booster and one single-phase testing transformer.*

November 28th. Outdoor and indoor sub-station switchgear in connection with the Mangahao power scheme.*

Reigate.—September 26th. Town Council. H.p. switchgear. (September 15th.)

Southport.—September 25th. Relaying about 1,800 yards of single tramway track with new rails. A. E. Jackson, M.I.C.E., borough engineer and surveyor, Town Hall.

Uruguay.—Monte Video.—November 11th. State Electricity Department. One 10,000-kW turbo-generator. State Electricity Department, Calle Julio Herrera, 1458, Monte Video.*

October 3rd. 10,000 metres 3 mm² rubber insulated cable.

October 4th. 80,000 metres 10 mm², 30,000 metres 20 mm², 25,000 metres 25 mm² paper-insulated cable.*

October 6th. 15,000 metres 2 x .75 mm² rubber-insulated cords for interior use.*

October 9th. 18,600 metres v.i.r. lead-covered cable, various sizes.*

October 31st. Switchgear for 15 transformer sub-stations.*

November 21st. 15,000 metres 3 x 32 mm², 36,000 metres 3 x 64 mm², 15,000 metres 3 x 80 mm², 3-ph., h.p. cable; 450 junction boxes; 350 vertical end boxes.*

Warrington. — September 26th. Board of Guardians. Electrical supplies for three months for Whitecross Institution and Cottage Homes, Padgate. Mr. A. Bottomley, clerk to Guardians, Bewsey Chambers, Warrington.

*A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Australia.—Orange, N.S.W.—Municipal Council. Accepted: Two 250-kW B.T.H. generators and condensing plant by Zollner, Ltd. (£7,146).—Australian General Electric Co., Ltd.—*Tenders.*

Bradford.—Tramways Committee.

20 tons Peckham hand-brake shoes (£190), and 20 tons track-brake blocks (£200).—W. H. Booth.

Electricity Committee.

Steelwork for sub-station in Sunbridge Road.—Hy. Barrett & Sons, Ltd.; A. Robinson.

Holmfirth.—Urban District Council. Accepted:—

Alterations to plant in connection with the electricity scheme.—Johnson and Phillips, Ltd.

London.—St. Pancras.—Electricity and Public Lighting Committee. Recommended:—

1,000 tons Bentinck nutty slack (21s. 5d. per ton); 1,000 tons Pinxton low main nutty slack (21s. 5d. per ton); 500 tons Pinxton ¼-in. nutty slack (18s. 5d. per ton).—J. H. Beattie & Co., Ltd.

Highways, Sewers, and Public Works Committee. Recommended:—

Supply of two electric motor vehicles.

Two 3-ton electric vehicles (£825 each).—Clayton Wagons, Ltd.

Two 3½-ton ditto (£875 each).—Richd. Garrett & Sons, Ltd. (recommended).

Two 3½-ton ditto (£890 each).—General Vehicle Co., Ltd.

Two 3-ton Orwell ditto (£865 each, plus extras); or two 3½-ton ditto, plus extras (£895 each).—Mossay & Co., Ltd.

Two 3½-4-ton Newton Derby Electrics (£1,156 each).

Mansfield.—Town Council. Accepted:—

Induced-draught fan and economiser.—Babcock & Wilcox, Ltd.

Portsmouth.—Town Council. Accepted:—
Four electrically-driven vans for scavenging purposes (£1,500 each).—Electricars, Ltd.

Salford.—Town Council. Accepted contracts in connection with the Agecroft generating station:—
Steelwork for turbine and boiler-houses, &c. (£37,596).—E. Wood & Co., Ltd.
Excavations, concrete and brickwork (£73,632).—Sir R. McAlpine & Sons.
Cranes, &c.—Marshall, Fleming & Co., Ltd.

Sunderland.—Town Council. Accepted:—
Reconstruction of two feeder cubicles.—Met.-Vickers Electrical Co., Ltd.
Two truck-type cubicles.—General Electric Co., Ltd.
E.h.p. switchgear.—Schull & Cullinan and Brush Electrl. Eng. Co., Ltd.
Cast-iron feeder-pillars.—W. T. Henley's Teleg. Works Co., Ltd.
Two recording voltmeters.—Cambridge & Paul Instrument Co., Ltd.
E.h.p. three-phase meter-testing equipment.—Met.-Vickers Electrl. Co., Ltd.
Fifty service boxes.—Callender's Cable & Constn. Co., Ltd.
1,000 yd. single-way earthenware ducts.—Albion Clay Co., Ltd.
6,000 yd. creosoted redwood capping.—Armstrong, Addison & Co.
Parts for air pump.—A.E.G., Berlin.
Tires for electric vehicles.—Dunlop Rubber Co., Ltd.
3 cwt. insulating tape.—India-Rubber, Gutta-Percha & Tele. Works Co., Ltd.

West Indies.—Messrs. Chiswell & Co., of Kingsway, London, have recently placed an order for a new power station roof with Messrs. John Lysaght, Ltd.; and one for a 15-ton crane with Messrs. Herbert Morris, Ltd.

York.—Electricity Committee.
1,000-kW rotary converter, transformer, and switchboard (£4,278).—British Thomson-Houston Co., Ltd.

FORTHCOMING EVENTS.

Institute of Cost and Works Accountants (London and District Branch).—Wednesday, September 27th. At the Institute of Chartered Accountants, Staple Inn Buildings, W.C. At 7 p.m. Address on "Collection of Data for Ascertaining Overhead Expenses," by Mr. R. Stelling.

Society of Engineers.—Friday, September 29th. At the Engineers' Club, London, W.C. At 3 p.m. Conference of members of engineering societies.

All-British Wireless Exhibition.—September 30th to October 7th. At the Horticultural Hall, Westminster, S.W.

NOTES.

E.S.C.A. Concert.—The third Bohemian concert of the Electricity Supply Commercial Association will take place on Friday evening, October 6th, at 7.45 p.m. Mr. D. C. Clark, of the London Divisional Council, will take the chair, and an excellent programme has been arranged. Tickets (2s. 4d. each) can be obtained from members of the E.S.C.A., or from Mr. G. S. Watts, 121, Little Ealing Lane, Ealing, W.5.

Birmingham and District Electric Club.—The opening meeting of the winter session of this club was held on Saturday last, when Mr. Chris. Jones, M.I.E.E., delivered a lecture on "Coal-getting by Electricity." The lecturer gave a detailed description of the electrical plant installed in a modern colliery, and explained at some length the methods of installation, maintenance, and inspection of the plant so as to ensure safety, economy, and compliance with the Home Office Rules relating to the use of electricity in mines. Evidence was given that the installation of modern electrical methods had very materially increased the output of coal per man. The lecture was fully illustrated by lantern slides, diagrams and drawings.

Fatality.—At the power station, Seaview Road, Wallasey, a man named Davis, employed by the Metropolitan-Vickers Electrical Co., Manchester, and engaged on contract work for the Wallasey Corporation, was recently killed. The deceased was engaged in screwing nuts on a steel plate when he made an accidental contact with the switchboard, which resulted in a fatal shock.

Electrically-propelled Ships.—In the course of his presidential address to the Institute of Marine Engineers (Inc.) on September 12th, Engineer Vice-Admiral Sir Geo. G. Goodwin, K.C.B., L.L.D., remarks that of the methods of effecting the reduction between the high-speed turbine and the slow-running propeller, in America, and to a small extent in this country, electrical gearing has been favoured. It has some advantages over mechanical gearing, but it has also some disadvantages, especially at what may be termed the design stages. As far as he has been associated with such proposals they appear to be expensive in first cost and to require greater weight and space than in some cases can be allowed. Considerable economy in fuel has been claimed for this form of transmission, especially at low speed, and although there is no reason to doubt the accuracy of figures that have been published, care should be taken in making a comparison to ensure that the conditions and attendant circumstances are similar. Diesel engines with electric transmission are also attracting considerable attention on account of the low fuel costs involved and such systems offer some most interesting problems to the engineer. Many minds are working to overcome the disadvantages of electrical transmission referred to, and it is very probable that it will become one of the important problems of the future. The advice of the marine engineer will take a prominent part in guiding the conclusions, and should the system be extensively adopted, then marine engineers, or some section of them, will require some additions to their knowledge in order to enable them to take charge efficiently of the additions to the boilers and engines of their ships. Probably those qualified as marine engineers under Government regulations, and holding certificates of competency to take charge of machinery at sea, would require a special endorsement to cover the transmission machinery of this type.

Fire.—During a recent outbreak of fire in the cabin of the 100-ton electric crane at the fitting-out basin of Messrs. Scott's dockyard, Greenock, the switchboard was damaged.

Appointments Vacant.—Two assistant mains engineers (£5), for the Dublin Corporation electricity department. (See our advertisement pages to-day.)

The Tramway Dispute.—As we go to press we learn that the Joint Industrial Council which met on Wednesday failed to find a solution to the difficulty, and unanimously resolved to invite the assistance of the Ministry of Labour. Sir David Shackleton received the representatives of each party separately, and the conference was afterwards resumed, sitting until 7 p.m. On Thursday the employés' delegates were to meet and consider the report of Wednesday's proceedings, after which the Council was to meet again for further debate.

Wireless Telegraphy in Mines.—The Baggeridge Colliery in South Staffordshire, was recently the scene of some exceedingly interesting experiments, undertaken by a party of Birmingham wireless amateurs, with a view to demonstrating that wireless might be made a means of communication in the mine. Their efforts proved that not only is this practicable, but it is possessed of distinct advantages over the present methods, and would be especially valuable as a means of communication with entombed men in the event of a disaster.

The experiments were carried out with the co-operation of the chief electrical engineer of the pit-head staff, and a special permit for the underground transmissions was obtained from the Postmaster-General.

Apparatus similar to that in common use among amateurs was used. The receiving set, which was installed at the pit-head, was an ordinary three-valve circuit embodying reaction, and the aerial was made by suspending copper wire from a point on the steel hoisting gear, 100 ft. above the shaft, and attaching it to an adjacent railway bridge. The earth was a connection to one of the rails in the permanent way.

On this temporary arrangement the experimenters had the satisfaction of hearing the station at Bordeaux before the tests proper were commenced.

The transmitting gear was a portable valve set operated with a plate voltage of 180 V, and this was first installed in the cage. Here the "aerial" was made by winding wire in lattice-fashion across the roof, care being taken to insulate it well from the steel framework. For the earth connection a wire was laid across the steel floor, where one of the experimenters stood on it as a means of keeping it fixed.

Transmission was commenced while the cage slowly descended. It should be pointed out here, by the way, that this particular shaft is 700 yards deep, one of the deepest in the country. Curiously enough signals grew louder as the cage descended. This was due, undoubtedly, to the screening effect of steel structural work which had been built into the shaft for several hundred feet down. When the cage was at a point some 300 yards down, and well past the steel girders, signals reached their maximum strength, and attained a fine clear note, which was easily readable. This was maintained until the cage approached the bottom, where there was more structural steelwork. Here signals commenced rapidly to fade away and became almost inaudible when the cage touched bottom. Accordingly the set was taken out and set up alongside and the aerial improved by slinging it between pit-props. This, however, made but little difference, and the whole of the gear was taken along the workings for several hundred yards. The distance, measured through solid earth, was nearly three-quarters of a mile.

A more substantial aerial was made by laying 90 ft. of cable along the floor. The first transmission from this new position was received clearly above, and telephony was then tried. The carrier wave was heard very loudly and of uniform strength, but articulation was indistinct, only one or two words being distinguished. Variations in coupling were tried, but with little success, and it was manifest that for the time being, at any rate, Morse was more reliable than telephony.

A phenomenon noticeable throughout the whole of the transmissions underground was the extensive leakage of the high-pressure current into the air around. It has been suggested that this was due to the presence of heavy carbonic elements in the air of the mine, which might have a very appreciable absorbing effect upon the liberated electrical energy. Notwithstanding this the experiments were of a very successful nature, and prove that an interesting field for research awaits the radio-scientist and the mining engineer. The day may come when wireless sets will be as common in mines as they are on ships, performing service just as useful, particularly when disaster befalls those who work far below the surface of the earth.

Educational.—Whitworth Scholarships.—Among the successful candidates in the recent Board of Education competition for Whitworth Scholarships and Exhibitions were the following dockyard electrical fitter apprentices: John H. Shuttleworth (Portsmouth), William E. C. Lampert (Devonport), Horace G. Beer (Devonport), and Sydney W. Harman (Portsmouth). The first-named secured a scholarship and the others took exhibitions. The full number of exhibitions could not be awarded as the number of competitors was not great enough.

Bradford Municipal Technical College.—The new session offers specially attractive courses in the Electrical Engineering Department by specialists in the construction, operation and principles of design of electrical machinery, &c., in the production and transmission of energy, and also in radio engineering. The civil engineering department has been re-organised and extra facilities provided.

Northampton Polytechnic Institute.—We have received a copy of the Institute's "Announcements" for the session 1922-23, containing a great amount of matter relating to the numerous courses, social activities, &c., of the Institute. The evening courses commence during next week, continuing into May, 1923. The day courses commence on October 2nd.

INSTITUTION NOTES.

Electrical Power Engineers' Association.—Southern Division.—A lecture on "Boiler Efficiency under Test and Working Conditions" will be given by Mr. D. Wilson, of Messrs. Babcock & Wilcox, at the Institution of Electrical Engineers, Victoria Embankment, W.C., on Friday, October 6th, at 7 p.m.

Chief Technical Assistants' Association.—The following is the programme of the meetings to be held during the coming winter:—

October 5th.—Discussion on "Electric Vehicles," to be opened by Mr. J. D. Spark.
November 2nd.—Discussion on "Inter-running of Generating Stations," opened by Messrs. Chalmers and Merry.
December 7th.—Discussion on "Mercury Rectifiers," opened by Mr. H. F. J. Thompson.
1923.
January 4th.—Discussion on "A Mains Problem," opened by Mr. E. R. Ingram.
February 1st.—Discussion on "The Chlorination of Circulating Water, with Special Reference to the Cleaning of Condenser Tubes and Maintenance of High Vacuum," to be opened by Mr. J. R. J. Bowden.
March 1st.—Annual general meeting.

OUR PERSONAL COLUMN

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Mr. Bertram G. Kelly, A.M.I.E.E., has been appointed the first manager and engineer of the Electricity Department of Douglas Corporation.

The Times reports that Mr. William Henry Brown, secretary of the Metropolitan Railway Co., has just completed 50 years' service with the company. He was appointed as secretary in 1908.

On September 13th, at the Royal Victoria Station Hotel, Sheffield, the members of the Sheffield and District Section of the E.P.E.A. presented Mr. Howard Price with a silver tea tray in recognition of his excellent services as honorary secretary to the Section for two years. Mrs. Price was given a hand satchel.

Mr. J. Lally has retired from the Post Office Engineering Department, Leeds, after serving the department, and previously the late Telegraph Company, from 1880. His special work was on the outside portion of the telephone plant, and he laid the first paper-insulated cable in Leeds. Most of the present line plant was constructed under his supervision.

On the occasion of his marriage Mr. S. Simpson, electrical engineer, of Bradford, has been presented with an inlaid mahogany clock by the employés of Messrs. Mark, Shaw and Sons, Ltd., of the Milnsbridge Iron Works, the firm with which he is associated.

The marriage took place at Christ Church, Brondesbury, on September 16th, of Mr. Harry A. Moncrieff and Miss Kathleen J. Bramall. Mr. Moncrieff has been on the staff of the County of London Electric Supply Co. since leaving Dulwich College some 13 years ago. He was presented by the Head Office staff of the company with a set of glassware, and by the local offices with an oxydised oval mirror.

Mr. J. Cauthery informs us that he has resigned his position as chief engineer of the Spearing Boiler Co., Ltd., London.

Obituary.—Mr. L. H. Walter, M.A.—We deeply regret to announce the death of Mr. Louis Heathcote Walter, M.A., a member of the staff of the Institution of Electrical Engineers, who had been editor of *Science Abstracts* since 1903.

NEW COMPANIES REGISTERED.

Ros Taylor, Ltd. (184,351).—Private company. Registered September 13th. Capital, £2,000 in £1 shares (1,000 10 per cent. preference). To acquire the sole rights, privileges, and patents of an electrical incubator and brooder, the invention of Rosetta Taylor, and to carry on the business of poultry farmers and chicken rearers, manufacturers and sellers of the Ros Taylor patent electrical incubator and brooder, and all kinds of poultry houses, appliances and utensils, &c. The first directors are: A. A. Borland, 46, Manor Road, Bexhill; F. R. J. Bell, 7, Queen's Gate, S.W.1; Miss Rosetta Taylor, 114, Heythorpe Street, Southfields, S.W.18; W. C. Bartlett, 7, Chantry Road, Brixton, S.W. Qualification: 1 share. Remuneration: £250 per annum, divided between them. Secretary: W. C. Bartlett. Registered office: 41, Lower Belgrave Street, Victoria, S.W.

National Engineering Supply Co., Ltd. (184,349).—Private company. Registered September 13th. Capital, £10,000 in £1 shares. To acquire the business of electrical, mechanical and general engineers and engineering supply store proprietors, &c., carried on at 1, West Bute Street, Cardiff, and elsewhere, as "The National Engineering Supply Co." The subscribers (each with one share) are: F. C. Phillips, 1, West Bute Street, Cardiff, electrical engineer; S. Beamand, 31, Ynis Street, Port Talbot, accountant. F. C. Phillips signs as director. Qualification: £500. Registered office: 1, West Bute Street, Cardiff.

Lincoln Electric Co.—Particulars were filed at Somerset House on September 11th, pursuant to Section 274 of the Companies (Consolidation) Act. The authorised capital was originally 10,000 dollars, but after successive increases, was at December 8th, 1919, 273,800 dollars in 20,000 common shares of 10 dollars each and 738 preferred shares of 100 dollars each. On December 31st, 1919, the capital was reorganised, being divided into 30,000 shares without nominal or par value and 738 preferred shares of 100 dollars each. The total amount of authorised capital was still stated as 273,800 dollars, the corporation certifying that it had assets to that actual value. The company was incorporated in U.S.A. on June 8th, 1906, to manufacture, repair, buy, sell and deal in all kinds of electrical machinery, tools and appliances, &c. The British address is Kern House, 36-38, Kingsway, W.C.2. G. T. Tavenner, of 22, Parliament Hill Mansions, Highgate Road, N.W.5, is authorised to accept service of process and notices. No list of directors has yet been filed. The file number is 2,137F.

Electois, Ltd. (184,253).—Private company. Registered September 8th. Capital, £2,500 in £1 shares. To acquire the business of the "C.A.M. Patents" carried on by W. A. Cuthell and L. Mynne at 18, Rullerton Road, Wallasey, together with all the assets used in connection therewith, including patent No. 33,569, of 1921, and to carry on the business of electrical, mechanical and general engineers, manufacturers of electrical or other motors, and electric or other lighting sets, toys of all kinds, &c. The permanent directors are: W. A. Cuthell, 18, Rullerton Road, Wallasey, marine engineer; L. Mynne, 18, Rullerton Road, Wallasey, electrical engineer. Qualification: £50. Remuneration: £100 per annum divided between them. Secretary: F. M. Stanbury. Registered office: 25, Lord Street, Liverpool.

Radio Components, Ltd. (184,294).—Private company. Registered September 11th. Capital, £2,000 in £1 shares. To carry on the business of manufacturers of and dealers in general electrical apparatus and machinery, and apparatus capable of being employed in wireless telegraphy and telephony, &c. The first directors are: A. P. Pope, Teddington, near Dunstable, Beds. (director Plant and Supplies, Ltd.); P. C. Curtis, 14, Cressida Road, Highgate. Registered office: 12 and 13, Henrietta Street, W.C.2.

Darimont Electric Batteries, Ltd. (184,270).—Private company. Registered September 9th. Capital £18,000 in 62,000 ordinary shares of 5s. each and 50,000 deferred shares of 1s. each. To adopt an agreement with L. Darimont and G. Hagemans; to acquire a licence to manufacture, under British Patent No. 180,120, a primary electric cell or battery, and other electrical appliances in the United Kingdom and elsewhere, except in the foreign countries where patents for the said invention have already been granted. The first directors are: L. Darimont, 10, Rue Sergent Debruyne, Brussels; G. Hagemans, 76, Rue Emanuel Van Drische, Brussels; F. Smith, Salisbury House, E.C.; Col. J. H. H. Hogge, 7 and 8, Norfolk Street, Strand, W.C.; W. R. Cooper, 82, Victoria Street, Westminster; B. Weiser, 15, Coleman Street, E.C. The first two are life directors. Qualification: 400 shares. Remuneration: 5 per cent. of the amount distributed as dividend, but not to exceed £2,000 in any year, divided between them. Solicitors: Perowne & Co., 7, Great James Street, Bedford Row, W.C.1.

Radio Installations, Ltd. (184,320).—Private company. Registered September 12th. Capital, £1,000 in 700 shares of £1 each and 6,000 shares of 1s. each. To carry on the business of manufacturers of, agents for, and dealers in instruments, apparatus, accessories and materials of all kinds for use in connection with radio or wireless telegraphy, or with stations, exchanges, and lines for the distribution or reception of radio or wireless waves, &c. The permanent directors are: P. H. Pettyfer, 17, Albemarle Road, Beckenham, Kent; A. J. Hancock, 26, High Street, Beckenham, Kent. Qualification: £100. Registered office: Empire House, 175, Piccadilly, W.

Association of Municipal Traders.—Registered on September 15th as a company limited by guarantee. The objects are: To promote and protect the interests of persons, firms and companies (referred to as "Municipal Traders") engaged in trades, businesses and undertakings, entering into contracts with, doing work for, supplying goods to or employed in relation to the requirements of municipal corporations, county, district, and parish councils, poor law guardians, statutory undertakings or any other corporation, board or authority; to collect information relating to the business of, or of use or interest to, municipal traders and others, &c. The management is vested in a committee, the first members of which are:—F. E. Bristowe, St. Stephen's House, Victoria Embankment, S.W.1, engineer; I. W. Benson, Pinners Hall, E.C.; A. M. Bond, 34, Victoria Street, S.W., contractor; H. G. Blakemore, 16, Grosvenor Gardens, S.W.1, engineer; W. H. Prescott, 712, Salisbury House, E.C., civil engineer; J. S. Killick, Shell Corner, Kingsway, W.C., civil engineer; W. H. Chappell, 65, Victoria Street, S.W.1, director. The secretary is A. Hutchinson, and the solicitors are Oldham, Cornwall & Wood Roberts, of 3, Harcourt Buildings, Temple, E.C. The registered office is at 40, Broadway, Westminster. The file number is 184,377.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

T. Jackson, Sons & Co., Ltd.—Satisfaction in full on September 5th, 1922, of debenture, and the collateral security both dated May 21st, 1915, securing £1,000.

Cray Installations, Ltd.—J. T. Matthews, of St. Michael Chambers, 126, High Street, Southampton, was appointed receiver on September 5th, 1922, under powers contained in debentures dated March 17th, 1921.

Gorseinon Electric Light Co., Ltd.—Satisfaction in full on July 5th, 1922, of debenture dated September 11th, 1902, securing £800.

Simms Motor Units (1920), Ltd.—Satisfaction to the extent of £1,608 12s. 1d. on September 5th, 1922, of land registry charge dated April 30th, 1921, securing £4,818 15s.

CITY NOTES.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.

Mr. G. C. Howard, presiding at the ordinary general meeting on September 14th, said that the year's results, although disappointing, were not unsatisfactory, when due regard was paid to the circumstances. There had been a railway strike, a tramway strike, and a strike of firewood loaders, each of which had a detrimental effect upon the company. The mines were also handicapped by the lower gold premiums.

The whole of the debenture debt of £61,200 had been repaid out of profits, and the property was now absolutely unencumbered. The chairman considered that compulsory arbitration in Australia had proved a failure and a check upon enterprise.

After the general meeting, a meeting of the preference shareholders was held to consider a scheme of arrangement. It was proposed that the holders should surrender their £150,000 of preference shares, receiving in return debenture stock to the same amount. Their voting rights would be retained. The scheme was approved and afterwards confirmed by a meeting of the holders of ordinary shares and an extraordinary general meeting of the company.

German Companies.

The *German South Sea Wireless Telegraphy Co.*, of Berlin, has now published its accounts for 1915-16 to 1921-22, showing a loss of 169,000 marks for these years on a share capital of 1,300,000 marks.

The *Continental Isola Works Co.*, of Duren, reports net profits of 1,166,000 marks for 1921-22 and a dividend at the rate of 12 per cent., these results comparing with 892,000 marks and 12 per cent. respectively in the previous year.

The *Electro Works Co.*, which owns power stations in Central Germany and whose share capital is held entirely by the State, reports net profits of 14,460,000 marks for 1921, which is the first year since the absorption of similar works. The dividend is at the rate of 8 per cent. on capital of 12,600,000 marks, the balance of the profits being placed to reserve funds.

Stock Exchange Notices.—Application has been made to the Exchange Committee to allow the following to be officially quoted :—

Jutland Telephone.—£500,000 5½ per cent. sterling bonds of 1922 (Nos. A1 to A3,500—£100 and B1 to B300—£500) (guaranteed by Danish Government), in lieu of scrip now quoted.

Dealings in the following securities have been specially allowed by the Committee under Rule 159, and they have been ordered to be officially quoted :—

Marconi's Wireless Telegraph.—73,094 ordinary shares of £1 each, fully paid (Nos. 1,473,649 to 1,500,000 and 2,953,259 to 3,000,000).

Prospectus.—*Haywards Heath and District Electric Supply Co., Ltd.*—Last week this company published a prospectus in the Sussex newspaper Press inviting subscriptions for 20,000 £1 shares at par. The area of supply is a residential one with a population of about 15,000. The list is to close on September 23rd.

Hendon Electric Supply Co., Ltd.—According to a financial daily, an interim dividend of 5 per cent., free of tax, on the ordinary shares for the past half year is announced.

Stothert & Pitt, Ltd.—Profit for year ended June 30th, 1922, £28,658, plus £5,153 brought forward, making £33,811. Final dividend of 7½ per cent., free of tax, making 12½ per cent., free of tax, on ordinary shares, carrying £7,020 forward. Outstanding debentures of £25,000 were paid off on June 1st, 1922, leaving assets now uncharged.

Mackay Companies.—An interim dividend of 1¼ per cent. for the quarter on the common stock is announced.

Browett, Lindley & Co., Ltd.—Interim dividend of 4 per cent. actual, less tax, on the ordinary shares.

Bruce Peebles & Co., Ltd.—Dividend at the rate of 7½ per cent. per annum, less income tax, on the 7½ per cent. cumulative participating preference shares for the half year ended June 30th.

Whitehall Electric Investments, Ltd.—Interim dividend at the rate of 7½ per cent. per annum on cumulative preference shares for six months ending September 30th.

Dumbarton Burgh and County Tramways Co.—According to the *Financial Times*, the directors have resolved to pass the preference dividend for the half year to July 31st, 1922.

Sir W. G. Armstrong, Whitworth Co., Ltd.—Interim dividend on the ordinary shares of 6d. per share, less tax.

Howard & Bullough, Ltd.—Quarterly interim dividend of 6d. per share on ordinary shares.

British Insulated & Helsby Cables, Ltd.—An interim dividend of 9d. per share, less tax, is announced.

Rangoon Electric Tramway and Supply Co., Ltd.—The *Financier* says that cable advice has been received to the effect that the directors have declared an interim dividend on ordinary shares at the rate of 8 annas per share, payable in Rangoon on October 31st.

Shawinigan Water and Power Co.—Dividend of 1¾ per cent. on common stock for the quarter ended September 30th.

STOCKS AND SHARES.

Tuesday Evening.

International complications laid a heavy hand upon the Stock Exchange markets at the beginning of the week. There was a general fall in the War Loan, Home Railway stocks, and other investment securities. Prices of semi-speculative issues gave way with the rest. Indian stocks and shares have been particularly depressed by the Near East crisis. While nobody affected to believe that Europe would again be plunged into war, the prospect of such a thing came sufficiently near to render the markets apprehensive. In some, a good deal of selling has been taking place; and in most, the ordinary buyer refrained from taking a hand while the outlook continued unsettling and threatening. The more cheerful aspect that developed on Tuesday, led to recovery all round. Many of the falls were recovered, either entirely or in greater part.

For the reasons stated, Home Railway stocks of all kinds went lower. The Undergrounds suffered with the rest. Underground Electric £10 shares, for instance, which rose to 56s. came back to 52s. 6d., and the Income Bonds, after touching 87, receded to 84¼. Districts and Metropolitans were lowered in the same kind of way, but the subsequent rally caused a smart recovery in the whole group.

It is being asked how soon the steam companies will put into operation those schemes for electrification upon the strength of which they have received promises of Government-guarantee support for new issues, on the condition that the work should be put in hand without delay. The South-Eastern Railway, for instance, received an assurance of Government guarantee for 6½ millions new capital, of which five millions was to be applied to electrification purposes, provided that the work was started as soon as possible. So far as we are aware, no active steps have been yet taken towards this end, apart, of course, from the evidence that was tendered to the Commission, about four months ago, with a view to ascertaining what source of supply would be the best and cheapest for the railway company to adopt.

Electricity supply shares are not much affected by the general dulness prevailing in other parts of the Stock Exchange. The new County ordinary eased off to 3s. premium, and the new preference to 1s. 9d. premium, the decline being due to the fact of there being another call due on October 1st. Possibly some of the stags, who have been holding on in the hope of getting a bigger premium, are realising at the substantial profit which they can still secure. It is pointed out in the current number of the *Economist* that the electricity supply companies are doing remarkably well on account of the reduction in the cost of coal, materials, labour, and other expenses which have fallen out of proportion, at present, to the cost of the current supplied to customers. This view obviously weighs with holders of the shares, who are disinclined to part with investments upon which there is every reason to expect an improvement in dividends in respect of the current year, and it explains the reason why there are so few shares available for prospective buyers, attracted by the prosperity of the industry. The buyers have to wait, as a rule, for odd lots of "deceased-account" shares which trickle into the market every now and then, and which constitute almost the only source of supply at the present time.

Westminsters have given way to 7½ and County of London ordinary at 28s. are 9d. down. Similar loss lowered City of London ordinary to 2 1/16, but London Electrics hardened to 2½, business being marked up to 52s. 6d. St. James' rose to 9; South Londons to 4. Whitehall Electric preference are better at 18s. 9d., and the 6 per cent. debentures hardened to 89, on declaration of the dividend on the former. Amongst the manufacturing shares, General Electrics are a fairly active market on the basis of 19s., at which price the quotation shows a slight improvement. English Electric preference stiffened to £1. In the ordinary shares a few bargains are recorded around 15s. 9d. and 16s. Edison Swans have been changing hands at 3s. British Insulated at 45s. are 3s. higher.

Amongst the cable shares, Henleys at 2¼ are 1/16 lower, sellers having been attracted by the way in which the price has consistently risen during the past few weeks. Callenders remain at 2 3/16 and Telegraph Constructions at 25¼, Siemens also being without alteration at 27s. 6d.

Anglo-Argentine Tramways 5 per cent. first debenture stock at 78½ looks reasonably cheap on another fall of 1½ points. Brazilian Tractions at 50 are down 3, other issues in this market being very quiet. Mexicans have once more assumed a dullish tendency, though there are no changes to record in the list of prices. Doubt now seems to be entertained as to whether Congress will be unanimous in ratifying the proposal of the President of Mexico for dealing with the country's debt. It may be, however, that this sentiment is coloured by the dulness engendered by reason of the Near East problems, and, although the latter show signs this (Tuesday) afternoon of being dispersed, the foreign traction group failed

to recover as promptly as did some of the other sections round the Stock Exchange.

Marconis weakened to 2¼, which showed a loss of ¼. Radio Corporations gave way to 20s. 6d., the preferred to 13s. 9d. West India and Panama shares have been dealt in at 3s. 9d. The first preference drooped to 25s. United River Plate Telephones are 5s. lower at 6¼. Anglo-American deferred at 23½ has gone back to the figure at which it stood before the rise last week. The Eastern Cable stocks show no changes at all.

Several of the Indian issues have gone back a little, in consequence of the Near East quarrel. Indian Electric Supply and Traction 5 per cent. free-of-tax debentures can be bought at 94, the issue price. Calcutta Tramways 7 per cent. second debentures hold their premium of 2½ points on the issue price of 95, while Madras Electric 7 per cent. second debentures, which also came out at 95, are obtainable at a slight discount. British Thomson-Houston 7 per cent. mortgage debenture stock stands at 105, Lancashire Electric 7½ per cent. prior-lien debenture at 107, Midland Counties 5 per cent. first mortgage debenture at 92 and the company's 7½ per cent. mortgage debenture stock at 102.

The rubber market continues a little less dismal than it has been, but it cannot be said that there is any noticeable increase of business. Armament shares are quiet; the Armstrong dividend was better than had been expected. Babcock and Wilcox receded to 58s. 9d. In other engineering issues the tendency is to follow the meagre and irregular changes shown by the market for iron, coal, and steel shares.

British Electric Traction ordinary has gone back to 60. Metropolitan Electric Tramways 4½ per cent. debenture at 68½ is three points higher on the week.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend		Price Sept. 18,	Rise or	Yield
	1920.	1921.	1922.	fall.	p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	8	+ ½	£7 10 0
Charing Cross Ordinary	8	9	7⅞	—	5 17 0
do. do. 4½ Pref.	4½	4½	4	—	5 12 6
Chelsea	6	6	6½	—	4 16 0
City of London	14	14	2½	—9d.	6 11 9
do. do. 6 per cent. Pref.	6	6	23/-	—	5 4 4
County of London	8	8	28/-	—9d.	5 14 4
do. do. 6 per cent. Pref.	6	6	23/-	—	5 4 4
Kensington Ordinary	9	10	7½	—	6 13 4
London Electric	3½	4	2⅝	+ ⅛	4 16 0
do. do. 6 per cent. Pref.	6	6	6	—	5 17 1
Metropolitan	7	7	6⅝	—	5 14 3
do. 4½ per cent. Pref.	4½	4½	4	—	5 12 6
St. James' and Pall Mall	12	12	9	+ ½	6 13 4
South London	7	7	4	+ ⅛	7 0 0
South Metropolitan Pref.	7	7	1⅞	—	5 18 0
Westminster Ordinary	10	10	7⅛	— ½	6 11 2
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref	6	6	104	—	5 15 5
do. Def.	1½	34/6	23½	— ½	7 8 6
Chile Telephone	6	6	6	—	5 0 0
Cuba Sub. Ord.	7	7	8½	—	8 9 8
Eastern Extension	10	10	18½	—	5 6 8
Eastern Tel. Ord.	10	10	186½	—	5 7 3
Globe Tel. and T. Ord.	10	10	19½	—	5 8 5
do. do. Pref.	6	6	11½	—	5 2 2
Great Northern Tel.	24	22	29½	—	7 9 2
Indo-European	10	10	35½	—	7 0 10
Marconi	25	15	2¼	— ⅛	6 6 4
Oriental Telephone Ord.	12	12	2⅜	—	*5 1 1
United R. Plate Tel.	8	8	6¼	— ½	*5 18 6
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	19	—	*5 5 8
Home Rails.					
Central London Ord. Assented	4	4	87	—	5 19 5
Metropolitan	1½	2½	56	—1½	4 0 4
do District	Nil	1	42	—	2 6 6
Underground Electric Ordinary	Nil	Nil	2⅜	+ ⅛	Nil
do. do. "A"	Nil	Nil	7/6	+6d.	Nil
do. do. Income	2	4	86½xd	+1	*4 13 6
Foreign Trams, &c.					
Anglo-Arg. Trams. First Pref.	5½	12½	8⅞	—	8 0 0
do. do. 2nd Pref.	Nil	5½	8½	—	7 0 9
do. do. 5 per cent. Deb.	5	5	78½	—1½	6 7 5
Brazil Tractions	Nil	Nil	50	—3	8 0 0
British Columbia Elec. Rly. Pcc.	5	5	76¼	—	6 9 9
do. do. Preferred	5	93/-	66	—	*7 1 3
do. do. Deferred	3	124/-	72½	—	*8 11 0
do. do. Deb.	4½	4½	76	—	5 11 6
Mexico Trams. 5 per cent. Bonds	Nil	Nil	70½	—	7 1 10
do. do. 6 per cent. Bonds	Nil	Nil	41½	—	Nil
Mexican Light Common	Nil	Nil	20½	—	Nil
do. Pref.	Nil	Nil	48½	—	Nil
do. 1st Bonds	Nil	5	84½	—	7 14 6
Manufacturing Companies					
Babcock & Wilcox	15	15	2¼	— ⅛	5 12 3
British Aluminium Ord.	10	10	18/9	—	—
British Insulated Ord.	15	15	2½	+3/-	6 13 4
Callenders	15	15	2⅛	—	6 17 0
„ 6½ Pref.	6½	6½	1¼	—	5 15 7
Crompton Ord.	10	5	15/-	—	6 13 4
Edison-Swan	10	Nil	3/3	—	Nil
do. do. 5 per cent. Deb.	5	5	64	—	7 16 4
Electric Construction	10	10	1¼	—	8 0 0
English Electric	8	5	16/-	—	6 5 0
do. do. Pref.	6	6	1	+6d.	6 0 0
Gen. Elec. Pref.	6½	6½	22/-	—	5 18 2
do. Ord.	10	5	19/-	+3d.	5 5 3
Henley	15	15	2½	— ½	6 9 10
do. 4½ Pref.	4½	4½	4½	—	5 2 10
India-Rubber	10	—	¼	—	—
Met.-Vickers Pref.	8	8	2½	—	6 8 0
Siemens Ord.	10	10	27/6	—	*7 5 6
Telegraph Con.	20	20	2½	—	*4 13 6

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, September 20th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... per lb.	7½d.	...
a Ammoniac, Sal ... per ton	£63	...
a Ammonia, Muriate (large crystal) „	£48	...
a Bisulphide of Carbon ... „	...	...
a Borax ... „	£30	...
a Copper Sulphate ... „	£26 10s.	...
a Potash, Chlorate ... per lb.	5d. to 5½d.	...
a „ Perchlorate ... „	7½d.	...
a Shellac ... per cwt.	£16	...
a Sulphur, Sublimed Flowers ... „	£11 10s.	...
a „ Lump ... „	£11	...
a Soda, Chlorate ... per lb.	3½d.	...
a „ Crystals ... per ton	£6	...
a Sodium Bichromate, casks ... per lb.	5d.	...
METALS, &c.		
b Aluminium, Ingots ... per ton	£100	...
b „ Wire ... per lb.	1/9 to 2/6	...
b „ Sheet ... „	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... per ton net	£150	...
Grade II ... „ „	£108	...
Grade III ... „ „	£62	...
c Brass (rolled metal 2" to 12" basis) per lb.	9½d.	...
c „ Tubes (solid drawn) ... „	11¾d. to 1/-	...
c „ Wire, basis ... ... „	9½d.	...
c Copper Tubes (solid drawn) ... „	1/1½	...
c „ Bars (best selected) ... per ton	£94	...
c „ Sheet ... ... „	£94	...
c „ Rod ... ... „	£94	...
d „ (Electrolytic) Bars ... „	£71 10s.	10s. inc.
d „ „ Sheets ... „	£145 10s.	...
d „ „ Wire Rods ... „	£81 10s.	10s. inc.
d „ „ H.C. Wire per lb.	10¾d.	...
f Ebonite Rod ... ... „	3/6	...
f „ Sheet ... ... „	3/-	...
a German Silver Wire ... ... „	2/6	...
h Gutta-percha, fine ... ... „	12/6	...
h India-rubber, Para fine ... ... „	10½d.	...
l Iron Pig (Cleveland Warrants) ... per ton	92s. 6d. to 95s.	...
l „ Wire, galv. No. 8, P.O. qual. „	£24	...
g Lead, English Pig ... ... „	£25 5s.	5s. dec.
g Mercury ... ... per bot.	£12 10s. to £12 15s.	...
e Mica (in original cases) small ... per lb.	3d. to 8/-	...
e „ „ medium ... „	4/- to 8/-	...
e „ „ large ... „	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings „	1/1	...
p „ drawn bars and rods „	1/3	...
p „ rolled strip & sheet „	1/2½	...
p „ wire ... ... „	1/3½	...
o Platinum ... ... per oz.	£26	...
d Silicium Bronze Wire ... ... per lb.	1/1	...
r Steel, Magnet, in bars ... ... „	1/-	...
n Tin, Block (English) ... ... per ton	£159 5/- to £159 10/-	...
n „ Wire, Nos. 1 to 16 ... ... per lb.	8/-	...

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r. W. F. Dennis & Co.

Scandinavian Power Transmission.—The greatest secrecy has hitherto been observed concerning the schemes for the transmission of power from Norway to Denmark, which question is engaging the attention of a joint committee of these two countries and of Sweden. A final meeting of the technical committee, appointed by the latter, is to be held in Copenhagen at the end of September, when an official statement is expected to be issued. In the meantime it is reported from Stockholm that the scheme for the transmission of power by means of submarine cables laid across the Sound has been abandoned, as it has been shown to be technically practicable to utilise the airway. According to a Christiania newspaper, this project has been worked out by a Norwegian engineer (Mr. Prebensen Nissen) who is a member of the technical committee. It had been thought that the Sound was too deep to permit of the construction of towers to support an overhead transmission line, but this has turned out not to be the case. It will thus be possible to install an overhead line directly between Helsingborg (Sweden) and the west coast of Zealand, which is of the greatest importance for the technical solution of the problem. It was originally proposed to transmit power at 132,000 volts through three submarine cables in the Sound, and subsequently increase the number to six.

Belgian Radium Factory.—The radium factory which is being built at Campine, Belgium, is almost completed, and it is expected that the first supply of radium from minerals obtained from Katanga will be produced by the end of this year. —*Daily Telegraph.*

THE BRITISH ASSOCIATION.—III.

Monday morning (September 11th) was spent by Section G in the discussion of a series of papers on "Economic Steam Production, with Special Reference to Marine Practice," a feature of which was a statement by Dr. C. H. Lander, on behalf of the Fuel Research Board, in which the suitability of oil for steam-raising purposes was discussed. The problem is one which has some interest for those who have to deal with stationary boilers, and those who were forced to adopt oil firing during the war—most of whom have abandoned it since—will be interested to hear, *apropos* of the Government scheme of boring for oil in this country, and the much-criticised expenditure in connection therewith, that the considered opinion of the Fuel Research Board is that the chief source of supply of home-produced oil must come from the distillation of coal in conjunction with processes for the manufacture of smokeless fuel. It has been known for a long time that the Navy has abandoned any reliance upon home oil supplies obtained from borings here, and it was with the idea of making the Navy independent of imported supplies that the boring scheme was commenced.

A paper on "The Acquisition of Skill, with Reference to Training in Industry" was read by Prof. T. H. Pear in Section J (Psychology). This dealt with many of the problems of industrial psychology in a more or less new manner, and the author somewhat caustically compared the care and expense which was often gone to in acquiring skill in games to the general absence of this same devotion to the problems of acquiring skill in work. This paper demonstrated, as had others before this Section, that those who practised the science of psychology in its industrial applications were beginning to realise that a more practical touch must be given to their work, and that the worker could not be regarded as an automaton which could be watched, tested, and generally ticketed and docketed, and expected to give a constant output under all and any conditions. It was clear that the so-called campaign of scientific management and efficiency propaganda, which was belauded a few years ago in this country, had more or less failed in the sense that its originators had had to call upon their disciples to halt. It was indeed amusing to those who had followed this branch to find the psychologists telling the self-styled efficiency engineer—a direct product of the industrial psychologists' teachings—that he, by his methods, had tended to bring the work of Taylor and the Gilbreths into disrepute. A more human point of view was being adopted, and not too soon.

Several of the Sections wound up their proceedings on Tuesday, September 12th, among them being Section A in which the papers on "The Ultramicrometer in Minute Physical Measurements," by Prof. R. Whiddington, and on "The Determination of Dielectric Constants and Susceptibilities by Valve Methods," by Mr. J. E. P. Wagstaff, both reproduced in our last issue, were read and discussed.

Although the title of the only paper read in Section G (Engineering) might not suggest electrical interest, *viz.*, "The Propelling Machinery of the Cargo Carrier of the Future," there were two points to which attention may be drawn. The author was Mr. J. Richardson, who is regarded as one of the leading experts of the Diesel engine. He is an old Central Technical College student, where he received electrical training under Prof. Howe, the Recorder of the Section, and it was Prof. Howe who pounced upon what was perhaps a loosely-expressed remark in the paper regarding the electrical driving of ships, *viz.*, that electrical machinery for marine work was only in its infancy. Prof. Howe stoutly challenged that statement, and said that any reputable firm of electrical manufacturers could do all that was required, and that the failures of which so much was made from time to time were due to the fact that the plant was not specially designed for the particular purpose in view; with this statement the author agreed. Mr. Richardson said that so far as steering gear was concerned, the electric-hydraulic system had proved itself efficient and was finding increasing favour even on steamships. For lights and fans electricity was also required. For the heating of a ship, steam was still the most convenient and the least costly method, although either exhaust-raised steam at sea or some combination of electrically-generated heat and hot-water pipes would no doubt find increasing favour in the future. Therefore, for the remainder of the plant, such as winches and pumps, the choice lay between steam or electric drive. Where first cost was concerned, considerable advantage lay on the side of steam, but the more elegant solution, and the more economical, in respect of fuel consumption, was undoubtedly the electric drive. Electric current was generated by Diesel-driven dynamos, which, except in very special cases, should not be less in number than three. For reasons of interchangeability, these three should be of the same size. One should be sufficient for normal sailing at sea, two were required for manœuvring the ship or for working cargo fully in port, and one was always a stand-by. For ships of 3,000 tons deadweight, three sets each of 50 kW would suffice. From 6,000 tons to 10,000 tons deadweight, three sets of 80 kW to 100 kW were generally required. If special provision had to be made, for instance, for carrying refrigerated cargoes, the power of the sets was greatly increased, and in some cases three or four sets of 150 kW were called for. The consumption of fuel for working cargo and pumps in port with banked fires in a steamship was of the order of 10 times the amount of fuel required by the Diesel electric system of auxiliary working on similar motor ships.

The foregoing referred particularly to four-cycle engined ships. When two-cycle machinery was adopted, the practice of driving the scavenging pumps separately from the main engine to permit of rotary machines being used for this duty would undoubtedly gain favour, and in this case the Diesel-driven generators for supplying electricity for general duties, as well as for driving these pumps, became of very considerable size, approximately 25 per cent. of the power of the main engine.

Such figures led naturally to a consideration whether the correct angle from which to review and attack the problem was not to regard the machinery of the ship as a central electric power station delivering current to electric motors for propulsion and all the other multifarious duties. For special-purpose ships, where the duties apart from propulsion required a substantial measure of the total power as, for instance, dredgers, ferry boats, cable ships, &c., the Diesel-electric system was being adopted and merited the closest attention. It was favoured in America, and had been regarded also, by virtue of the great sub-division possible, as a means of adapting the Diesel principle to ships of the highest power. It was heavy, the first cost was high, and electrical machinery suitable for marine work was only in its infancy, and much development must take place before the electrical equipment was as reliable as the remainder of the installation.

Incidentally, Prof. Hudson Beare, the President of the Section, referred to three fruit-carrying vessels which were being built with electric propulsion, Diesel engines being employed, but the author did not appear to approve of this plan. Another point brought out in the paper was that there was no sign of a reduction of the price of fuel oil to a figure that would enable it to compete with coal on ships, and presumably the same remark applied to land boilers.

Section B (Chemistry) had a more or less full-dress debate on the nitrogen industry, some details of which will appear in a later issue.

Only three sections met on September 13th, namely, Sections G (Engineering), H (Anthropology), and K (Botany). The only paper of electrical interest was that

by Dr. E. O. Turner, before Section G, on "Electrical Ignition Apparatus for Internal-Combustion Engines." Ignition, both by induction coil and by magneto, was discussed at some length, and results of experiments on induction coils designed for use with automobiles and with high-compression stationary gas engines were given. The magneto was considered in two aspects—as a constant flux alternator on short circuit for the first part of each cycle (until the contacts opened), and thereafter as an induction coil breaking the current just established. Expressions for the equivalent magnetic circuit and the "spark flux" were deduced, the latter being shown to be dependent on the short-circuit current and the equivalent permeance of the magneto.

Considerable emphasis was laid on the improvements made possible by the substitution of cobalt steel for tungsten steel magnets, and Dr. Turner predicted that in future cobalt steel would be used almost to the exclusion of tungsten steel, provided that improvements in the design of magnetos were brought about which would make its use an economic "proposition."

Prof. Hudson Beare, the President of the Section, welcomed an old student in Dr. Turner, and mentioned that his work in connection with ignition apparatus had led to his having been awarded the D.Sc. degree of Edinburgh University.

Some Geographical Aspects of Recent Developments of Water Power.

By H. M. Spink.—(*Abstract.*)

Section E.—Geography.

The author said that the question of the development of water-power in Great Britain had not secured the sufficiently wide interest that it deserved, partly due to the supremacy of coal in our industrial life, and partly also because our potential water-power resources were not large as compared with many other regions. This indifference was apt to rather blind us to the remarkable progress in water-power development which had taken place during the past twenty years, and especially to the social and economic effects which were extremely likely to follow such development. Interest was aroused for a time by the scheme for utilising tidal water in the Severn Estuary, and it was readily perceived that its completion would have had far-reaching influence in South-West England and South Wales. That, unhappily, had been forgotten, and it was also to be feared that the report of the British Water Power Committee had aroused insufficient interest. Few countries had made really reliable inquiries into their water-power resources. The value of the water power of streams was greatest where there was least variation in the flow. In regions of strongly-marked rainy periods and dry periods, while potential water powers might be very great when the streams were full, such powers might be valueless in the dry season. This made for uneconomical production of power, and lessened the value of the water-power. It was largely because of this fact that the production of power from the streams of Central Africa, South America, India, and South-Eastern Asia might be long delayed. The world's power demands were reckoned to amount annually to 120,000,000 h.p., of which factories, lighting, transport, &c., used 75,000,000 h.p., railways 21,000,000 h.p., and shipping 24,000,000 h.p. Only some 25,000,000 h.p. of hydro-electric power was developed out of a possible world's supply of 440,000,000 h.p. The Congo basin was estimated to possess 100,000,000 h.p., or about a quarter of the world's potential water-power, most of it available in the region about Stanley Falls. It was probable, therefore, that these great stores of energy would be utilised, but not without further development in the matter of long-distance transmission, and until it was possible to organise power demands to coincide with the periods of great stream flow in these regions. It would be said that hydro-electric development was a matter of relative costs, and that it would develop where it could successfully compete with steam plant. It was no part of the paper to discuss relative costs, but it might be said that hydro-electric power was extremely cheap where plants could be operated fairly continuously at full capacity. In Europe the average cost per h.p. year for the larger hydro-electric stations was about £10.5, while under favourable conditions, such as obtained for some of the huge plants of the Ontario Hydro-Electric Power Commission, this charge might fall as low as £1.8.

Dealing with some of the characteristic features of countries where water-power was largely used, the author stated that in North America there was an increasing degree of co-operation between steam-electric and hydro-electric plants. This was of great importance, because it involved no displacement of industry hitherto based on coal, and it suggested a line of logical development for hydro-electric power in areas where steam power was still the main source of energy. A scheme for developing this co-operation was being put into effect in the "super-power" zone in the New England States. Here the hydro-electric powers were of small capacity, incapable of supplying the needs of the area, but affording very considerable aid to steam-electric plants. In that area 25 per cent. of the population of the United States resided, and there were some 96,000 industrial plants, of which 76,000 utilised an average of 350 h.p. per year, mostly derived, uneconomically, from isolated power plants. Under the scheme the power plants would be reduced to 273, of which 218, being large undertakings, already existed, and would be retained. The combination of these steam and hydro-electric plants would almost entirely eliminate the movement of coal, except along specified routes, to the main steam plants. Out of 36,000 miles of railroad 19,000 miles would be electrified, and altogether there would be an annual saving of nearly 50 million tons of coal. In the chief industrial countries the railways were often embarrassed by the movement of coal to and from mines and the industrial centres. In New England the question had become acute, but it would now be largely eliminated.

The Niagara district of North America was undoubtedly first in the production of electrical energy. The Chippawa-Queenston plant, which had a capacity of between 500,000 and 600,000 h.p., was the largest hydro-electrical installation in the world.

A large number of slides of water-power plants in North America were shown, and attention was then given to Norway, Sweden, Italy, France, and Switzerland, the last of which had developed the greatest percentage (80 per cent.) of its available power. In France and Italy most of the hydro-electric power developed was devoted to specific industries rather than to the rural districts, and in this way they resembled the U.S.A. and Canada. In Italy, where there was little coal, great progress had been made, and whilst the lignite deposits were utilised as fully as possible the necessity for importing coal for railways and for smelting works imposed a heavy drain upon a comparatively poor nation. Electrification of railways in the Lombardy Plain was taking place, and there was a rapid extension of iron smelting by thermo-electric processes in the Aosta Valley near the Cogne iron deposits. Both lines of progress, it was to be hoped, would lead to the elimination of coal imports of about 4 million tons per annum. Maps were shown illustrating the great development of the uses of electric power for agricultural purposes on the Continent, possible on account of the cheapness of the supply of power generated by hydro-electric means. The map published by the Cartographical Institute of Stockholm was specially referred to in this connection. At the same time, in Norway, for instance, the amount of power used for agricultural purposes was still negligible, the vast bulk of the hydro-electric power being consumed by the aluminium works. In Sweden, out of 1,200,000 h.p. produced by the hydro-electric stations, 54 per cent. was used by industrial plants, 24 per cent. by thermo-electric processes, and only 7 per cent. for agriculture.

A similar idea, *viz.*, benefit to the rural population, lay behind the extensive Sila Lakes scheme of South Italy. The Sila was a tableland of 1,000 sq. km. in the Province of Cosenza, drained by the rivers Neto, Arvo, Ampollina, and others. It was proposed to convert the courses of these streams into a series of lakes by the construction of dams and impound a head of water with a fall of 1,000 metres. Hydro-electric plant, designed for 160,000 h.p., and capable of extension to 400,000 h.p., would be installed, and would supply power to Calabria and East Sicily. The scheme was to have been commenced in 1920, but the author said he had no information as to the amount of progress made.

The Future of Unemployment Insurance.

By J. L. Cohen, M.A.—(*Abstract*).

Section F.—Economics.

The author commenced with a study of the criticism to which the present scheme of unemployment insurance was subjected. It was agreed that the proportion of administration costs was too high. The accusation that applicants for relief were not always *bona-fide* unemployed was not accepted. It was pointed out that the normal income provided some nine-tenths of the expenditure. It was not correct to term the benefit "a dole," as unemployed workers had a right to it. Although it was not denied that there were errors in administration, the criticism was considered usually to be without foundation. Three lines of activity with the aim of reducing unemployment were suggested. An international body to correlate statistics of supply and demand was proposed. This body would regularise the demand for labour to safeguard against a boom to moderate its effects, and to prevent a reaction into a slump. It was suggested that benefits should vary with the amount of wages they would normally receive. The principles of the 1920 Unemployment Insurance Act were reviewed, and mention was made of the Bill which had been prepared contemplating the maintenance by each industry of its own unemployed. This scheme had supporters among both employers and workmen. Employers were reacting against the control of war-time economy, whilst trade union officials were fascinated by the guild socialist

ideal. During the war the "rota" system was introduced into the cotton industry. This was administered by the employers' organisations and trade unions. A similar scheme was worked in the Yorkshire wool textile trade for the establishment of a trade unemployment fund for hosiery workers. Schemes for the building trade and the docks industry had been suggested. Certain employers, like Messrs. Rowntree, had contracted out of the State scheme by establishing unemployment funds of their own. Labour authorities had, by a substantial majority, acclaimed the system. The reorganisation of insurance on the basis of industry was aimed at in the Bill of the General Federation of Trade Unions. The funds would be provided by a levy upon employers, one-fifth of which would be recoverable from the employés; the State would refund one-fifth of the amount paid out in benefits. Joint boards of employers and trade union representatives would administer the scheme, and any surplus would be paid at the end of the year to a central contingencies fund, from which deficits by other boards could be repaid. A national committee would adjudicate in disputes. The defects in this Bill were evident upon examination. Among these were the difficulty of defining industries; the marking down of men as belonging to one particular industry would affect the mobility of labour; the machinery of administration would be far too costly; employers would not be prepared to hand over to the unions large sums of money without demanding a very detailed control over them; at present each district had one employment exchange, the Bill would set up one for each industry, and the Government system of exchanges would still be required for unskilled labour. It had been suggested that all the existing schemes of insurance—unemployment, health, old-age, &c.—should be linked up to effect considerable economies; unemployment insurance by industries would render such a scheme very difficult of realisation. The assertion that unemployment insurance by industry would persuade employers to reduce unemployment, or reduce its severity, was stated to be fallacious, for several reasons.

Unemployment took on various forms in different industries, *e.g.*, the work of dockers was casual and intermittent; the gas and building trades suffered seasonal depression. The problem had been attacked in a novel way by Professor Common, of Wisconsin. It was proposed that all employers in the State of Wisconsin should form themselves into an "Employers' Mutual Employment Insurance Company." To prevent constant change of "hands" contributions to the fund would be regulated, being higher for the employer whose staff was constantly changing. This was also subject to the criticism that unemployment could not always be prevented by the employers.

The author's examination of the question led him to the conclusion that insurance by industry would be a troublesome and costly method; that it had no direct advantages over the State scheme; and that the indirect benefits, which were not very great, could be achieved by a slight amendment of the existing scheme. The present Act, slightly amended, should be tried for a decade before any fundamental revision was attempted.

Equal Pay to Men and Women for Equal Work.

By PROFESSOR F. Y. EDGEWORTH, M.A.—(*Abstract.*)

Section F.—Economics.

IN this paper the vexed question of the payment of women employed in industry was ably reviewed by the author. By "equal work" equal utility to an employer was generally meant; or, on the other hand, equal disutility, in the sense of fatigue or deprivation of amenity, to the employé. Should there be perfect competition between the sexes? This might be answered definitely in the affirmative or otherwise; if undecided, the question might be asked: "What sort or amount of competition is advisable?" It might happen that the unrestricted play of competition between short-sighted employers and desperately-poor workers, though securing a temporary maximum of production, might bring about a degradation of labour and a breakdown or a gradually deepening depression of industry. To this débâcle the competition of women would largely contribute. The minimum of requirements for efficiency was less for women than for men; wives and daughters were often subsidised, *i.e.*, not self-supporting; last, but not least, the woman worker had not acquired the same unwillingness to work for less than would support a family.

The best results would probably be obtained by leaving employers free to compete for male or female labour. Thus equal pay for equal work would be secured; this did not imply that the earnings of the sexes should be equal.

After a consideration of numerous factors affecting the question the author arrived at a number of conclusions, which he summarised as follows: Equal pay for equal work in the sense of free competition between the sexes was advocated, with some reservations and adjustments. Among the features which would have to be excluded was "desperate, disordered" competition, tending to the degradation of labour. There were suggested certain compensations to families for the loss sustained by the breadwinner through the increased competition of women; but among such compensations the endowment of motherhood on a large scale by the State was not included. The advantages weighed were economical in a strict sense; the balance might be affected when welfare or well-being in a wider sense was taken into account.

THE COLFAX GENERATING STATION, PITTSBURGH.

ACCORDING to Messrs. D. L. Galusha and C. W. E. Clarke, in a paper read before the American Institute of Electrical Engineers in 1921, the Pittsburgh, Pa., district is the foremost steel-producing and manufacturing centre in the United States. Steel plant with furnaces and mills lines the river banks for miles from the centre of the city. Associated industries, attracted by an abundance of natural resources, adequate transportation facilities, an ample labour supply, and proximity to markets for their products, have rapidly established themselves in the adjacent territory. Growth during the war period was extensive, and the district as a whole has been busy since hostilities ended.

By 1912 electricity generating station facilities in the Pittsburgh district had become inadequate to meet the requirements of the rapidly-growing industrial demand. The Allegheny County Light Co. and other companies, owning and operating a number of small properties, were consolidated with the Duquesne Light Co. A steam generating station previously built on Brunot's Island in the Ohio River below the city was considerably enlarged and the foundation laid for a comprehensive distribution system.

By an agreement with the West Penn Power Co. and with the approval of the Pennsylvania Public Service Commission, a definite division of the territory served by the two companies was effected. The Duquesne Light Co., through this arrangement, serves the two counties—Allegheny and Beaver—with an area of 1,154 square miles and a population of about one million and a quarter.

In 1913, the first year after the formation of the new company, the energy output was 283,000,000 kWh. In recent years the output has shown an average annual growth of about 15 per cent. In 1920 the peak, which was somewhat affected by the curtailment of business, was 162,500 kW; the energy output was 805,000,000 kWh, giving a yearly load factor of 57 per cent.

Previous to 1921 power was generated at the Brunot's Island station of 120,000 kW capacity, and by six other plants, varying from 2,000 to 17,000 kW in rating. The total generating capacity safely available from all of these sources under maximum conditions was 160,000 kW.

In anticipation of the need of increased capacity a site for a new power plant had been purchased on the Allegheny River about 15 miles from the centre of Pittsburgh and only a mile distant from the Harwick mine. This mine and the private railroad from it to the power station are owned by interests affiliated with the Duquesne Light Co. Actual construction of the new plant, known as the Colfax power station, was begun in September, 1919, and the station was officially opened for service on December 18th, 1920. Transmission line and sub-station construction was in progress during the same period.

Duplicate 66,000-volt transmission circuits completely surround the city, forming an electric belt 89 miles in circumference, locally known as "The Duquesne Ring." The Brunot's Island and Colfax stations are almost diametrically opposite each other in this ring. Six sub-stations located at intermediate points, fed from either or both generating stations, supply radial 22,000- and 11,000-volt feeders which, in turn, serve other sub-stations and consumers within the industrial district.

The flow of the Allegheny River, upon which the plant depends for condensing water, furnishes a natural limitation to the power which may be developed at Colfax. The minimum flow of this river is sufficient to furnish condensing water for 300,000 kW of plant; therefore, the design is such that the power station can be extended on a uniform plan until all the available condensing water has been utilised. To allow for contingencies and spare equipment a development somewhat beyond the minimum is provided for.

The size of the unit chosen, 60,000 kW nominal, is such that the ultimate development may be divided into five or six steps, and when the plant is completed it will not be complicated with a large number of small units.

The first step in the development, which includes one 60,000-kW turbo-generator and seven boilers, has now been in operation for nearly two years, and some particulars of its performance during that period will, therefore, be of interest.

The unit of plant consists of three 20,000-kW steam turbines arranged side by side, the high-pressure element in the centre and the two low-pressure elements on each side, with

their condensers below. They work together as one unit, the generators being electrically connected, synchronised, and switched on to the three step-up transformers and through to the 66,000-volt transmission line as one unit.

This is the third 60,000-kW set that the Westinghouse Electric & Manufacturing Co. has built, the first being installed at the 74th Street power house of the Interborough Rapid Transit Co., of New York City, and the second at the Government Nitrate plant at Mussels Shoals, Alabama.

The turbine of the middle element is of the single-flow type, taking steam at 265-lb. pressure and running at 1,800 revs. per minute. The turbines of the outer elements are of the semi-double-flow type, normally taking steam at 55 lb. per sq. in. and running at 1,200 revs. per min.

The condenser consists of four shells, each having 25,000 sq. ft. of surface, and 5,070 Muntz metal tubes 1 in. in diameter. Exhaust steam enters the top of each condenser through an elliptical opening, 14 ft. by 9 ft., and there is a similar opening at the side for the equalising pipe between condensers.

Steam is supplied by seven Babcock & Wilcox boilers (one being spare), each with 20,876 sq. ft. of heating surface and a superheater of 6,700 sq. ft. heating surface. They are the largest that have been built. Steam leaves the boilers at 265 lb. pressure and a temperature of 600 deg. F. Forced draught is used, and the chimney is 325 ft. above the firing floor and 21 ft. in diameter; the flues enter the chimney above the roof of the boiler-house. The boilers are in two rows parallel with the turbine room and the floor is 30 ft. above the turbine room floor. The main steam leader is 20 in. in diameter, with a double expansion bend of 18-in. pipe.

The three-phase electricity generators deliver 23,600 kVA at 85 per cent. power factor and 12,000 volts, 60 cycles. The windings are star connected and the voltage control is secured by a vibrating regulator with its contacts across the rheostats of a shunt-wound exciter and also by a control element, which adjusts by relay switches the position of the motor-operated contact arm of the generator-field rheostat.

There are four step-up transformers, one being spare, each with a capacity of 23,600 kVA, and the low-pressure side is wound for 12,000 volts in delta and the high-pressure sides of 66,000 or 132,000 volts in star. These transformers rank amongst the largest yet made; they are 10 ft. in diameter and 22 ft. high over the terminals.

The management of the Duquesne Light Co. has been so well pleased with the performance of the first set that it is being duplicated, and the design is the same except for a few minor details. This second set will be in operation by October, 1922.

The Colfax power-house is used as a base-load plant at high-load factor, the variations of the load being met by other stations. The same station economies could be obtained when operating under a "swinging" load, but the system of working calls for the Colfax station to be kept as fully loaded as is possible.

During the greater part of 1921, due partly to system-load conditions, and partly to plant conditions, the management was not able to utilise to the full advantage the possibilities of the first set of the plant, but since November, 1922, it has been operating under favourable conditions and giving consistent performance.

The data given below are for the month of April, 1922, and are representative of six months' performance :—

Net output	kWh	31,717,000
Peak load	kW	60,000
Load factor	per cent.	73.3
Total evaporation	lb.	418,485,424
Coal consumed	lb.	45,587,998
Coal rate	lb. per kWh	1.4373
B.th.u.	per kWh	18,691
Boiler efficiency	per cent.	77.2
Boiler rate	per cent.	171.4
Flue gas exit temp	deg. F.	463
Feed water temp.	deg. F.	202

Generating costs.—	Per kWh. Mils.
Superintendence and wages	0.58
Fuel	2.78
Miscellaneous operating expense	0.36
Total generating expense	3.72

The maintenance cost is not included because the data are not representative; considerably more time must elapse in order to determine the normal maintenance costs. The labour cost per kWh of output will drop considerably with the starting of the second set of plant. Fuel costs should decrease sharply, due to the reduction in the price of coal, and this reduction may be as much as 30 per cent.

The Duquesne Co. is especially well situated with respect to fuel supply by having available a very high-grade coal from mines owned and operated by an affiliated company, and a margin in price between producer and consumer is thus avoided.

In connection with the fuel consumption the station performance must be given consideration in view of the fact that no economisers or similar heat-reclamation apparatus are installed.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Night Landing Light for Aircraft.

A new combined lighthouse and aerodrome landing light, made by the well-known French firm, Messrs. Barbier, Benard & Turenne, has been shown at the London air port in the presence of representatives of the Air Ministry and several of the Naval and Air attachés. It is not very powerful; its lenses are made of the special optical glass for which the firm is famous; and where employed as a landing light, it has important properties. It sheds light over 180 degrees, with a radius of 750 yards, and it cuts off the light at so low an altitude that an airman coming to ground towards the lamp itself would not see the direct beams until his head was on a level with the lamp; in other words, until he was safely landed.

The light (fig. 1) is composed of a third-order lens having a focal distance of 500 mm. and built up of 21 dioptric elements. (The model illustrated is designed for military use, and therefore has a radius of 180 deg. as, in general, military operations call for light in one direction only. A 360 deg. lens could, of course, be supplied if all-round light was required.) The lens is fitted in a metal lantern carried by three adjustable bearings on a four-wheeled (solid rubber tires) truck; the bearings allow the light to be adjusted to the requisite elevation with considerable accuracy and a spirit-level is fitted for plumbing. The light source consists of a d.c. arc absorbing about 130 amperes at 60 volts (7¼ to 8 kilowatts) and the carbons which are automatically fed can also be adjusted by hand. The flashing arrangements consist of the usual Venetian-type shutter controlled by a small motor and a cam gear which can be adjusted to give the periodicity required; a separate lever enables Morse signals to be transmitted by hand.

In order that the light may be visible to aircraft flying close in at high altitudes, the top of the lantern carries a fourth-order lens (250 mm. focal distance) built up of six dioptric elements and subtending 360 deg. At the centre of this lens is fitted, in an adjustable carrier to permit exact focusing, a 500-watt metal-filament lamp which is so wired as to flash synchronously with the main beam. The top of this upper lens is closed by a ventilated glass dome. At the back of the lantern is a large inspection door giving easy access to the carbons and their carrier and on the left side is an instrument board with pilot light.

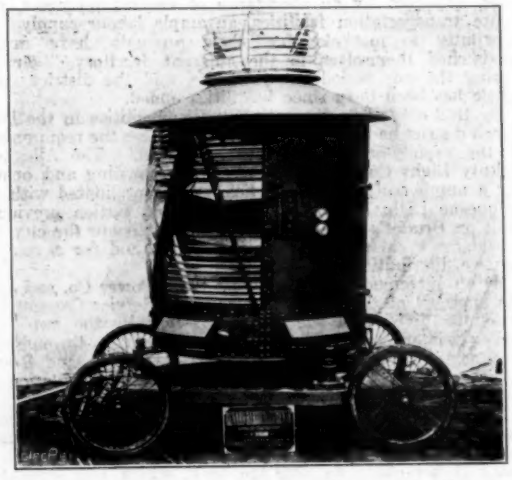


Fig. 1.—Aircraft Landing Light.

When used as a lighthouse, the lantern should be exactly plumb and preferably some five feet or so above the ground, unless situated on an elevation. The main beam has a vertical divergence of about 12 deg. above and below the horizontal line through the light source and the light is visible

to the naked eye at a range of 60 miles in normal European weather, with a considerable extension in dry climates. The light from the upper lens is visible under the same conditions at all flying heights as soon as the upper limit of the main beam has been passed.

When used as a landing light, the flashing device is switched off and the shutters are left open or entirely removed. The lantern should then be installed with its base about five feet above the ground and tilted forward about 12 deg. from the vertical till the upper limit of the beam is horizontal. In this position a semi-circular sheet of light is thrown on the ground giving effective illumination over about 750 yards radius and no direct light is visible to the pilot till his head is level with the top of the lantern. The upper light may still be used as a flashing signal or can be switched off entirely.

The "Wilcox" Tumbler Switch Coupler.

The coupling bar for a pair of tumbler switches illustrated in fig. 2 is the invention of Mr. Edward Wilcox, Beech Works, Heyes Lane, Timperley. It consists of a tube of hard, polished fibre with a hole bored near each end to accommodate the switch dollies. The ends of the tube are tapped to receive cupped screws which retain the dolly-heads securely in position. The couplers are made to suit 3, 5 or 10-A switches.

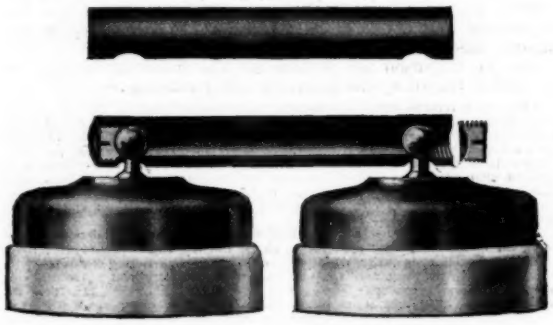


Fig. 2.—The "Wilcox" Switch Coupler.

Voltmeters for Wireless Sets.

It is imperative that the voltage of filament and plate batteries of wireless valve sets shall be checked from time to time. Obviously a combined instrument is most convenient for this purpose, and the Walsall Electrical Co. has filled this distinct want with a two-scale instrument, made up in portable and switchboard pattern. The former (fig. 3) is fitted with contact spike and flexible lead, and the switchboard instrument with terminals and fixing plate. Each instrument reads 0/10 on the low scale and 0/100 on the high. The latter is normally connected in circuit and the former is introduced by a plunger switch at the side of the instrument. Thus there is little fear of the low-scale coil being put on the high voltage. The instruments are neatly finished, and the London agents are Messrs. Lionel Robinson & Co., 3, Staple Inn, High Holborn, W.C.1.

Fig. 3.—Two-scale "Wireless" Voltmeter.

Italian Taxation.—A reduction of taxation burdens as a prelude for the recovery of business pleaded for by influential circles in England is, says the *Elettrotecnica*, much more needful in Italy, where the fiscal regulations by unduly limiting the sale price of energy have lowered the value of electrical, as also other, securities on the Bourse from 1¼ above the par value in 1914 to mere par value at the present time. In face of this enormous waste of wealth, the State must eventually end with having either itself to find the money for the new undertakings projected, or, alternatively, concede the needed fiscal relief.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Lightning Conductors on the County Hall.

May I explain, in reply to the letter of "Spark," in the Review of September 1st, that I do not understand how my letter could be read to create "a wrong impression." I simply referred to the fact that the steel framework of buildings had been used as a conductor before the County Hall. On inquiry, it appears that "Spark" is misinformed, in that there are no down tapes fitted to this building, I am surprised to hear from him that the water main only is used for the earth connection. It is a pleasure to hear again from Mr. H. G. Riddell, the electrical contractor, who took great pains in making sound connections bonding the metallic structure of the Mersey Dock Board's office, which occupies, if my memory is correct, the site of an old dock, and the (tubular) earths were sunk in the made ground under the structure. Mr. Riddell is quite right, there were no connections with (Liver) birds.

Killingworth Hedges.

Westminster, *September 13th*, 1922.

["Spark's" reference was to the part played by the National Physical Laboratory, which, he pointed out, did not specify that the steel framework should be used.—Eds. Elec. Rev.]

Estimates for Wiring Installations.

I have noted with interest the communications from Mr. Alan Kirk and "Lodestone," appearing in recent issues of the Electrical Review.

The points raised are of great importance to the electrical industry, and I am pleased to inform your readers that a paper is in course of preparation by members of this Association, which will deal with many of the questions referred to by your correspondents, and will also make reference to the effect of "Ring" prices and good organisation on the high cost of installations.

The paper will be read at the monthly meeting of the Association at the St. Bride's Institute, Ludgate Circus, E.C.4, on December 12th next, and full particulars will be issued through our usual channels. Tickets for the meeting will be obtainable by application to the undersigned.

A. Brammer,
General Secretary,
National Association of Supervising Electricians.

63, Queen Victoria Street, London, E.C.4.
September 12th, 1922.

Therms—and the Gas Bill.

Your excellent article on this subject, in your issue of the 8th inst., puts the whole source of the trouble clearly before your readers, and shows the responsibility of the gas companies as to the modification of burners to meet the changed unit thermal value of a cubic foot of gas.

There is, however, one point on which a question must be asked, namely, "Why therms"?

The gas is measured in cubic feet, and the gas companies state the calorific value of one cubic foot in B.th.u.—why, oh, why introduce in the consumers' bills a multiplication and division of heat units to make up a charge in therms instead of cubic feet of stated heat unit quality?

It looks very like mere cussedness in pedagogic pedantry.

W. Worby Beaumont.

London, *September 13th*, 1922.

The Pamphlet "Labour Trusts."

I have been much flattered by the notice that your reviewer gave last week to my "atrocious literary production," the pamphlet "Labour Trusts." I accept with gratitude the sympathy he apparently holds for me regarding my "endeavours to express my views," my incoherence, and my lack of care and experience in preparing matter for the Press.

I might point out, however, with all humility, that before passing the pamphlet for the Press I handed the proofs to three persons to read through, people who I looked upon as educated. One of them had been connected with technical journalism for many years. It may be that the persons in question got so interested in the contents of the pamphlet that they neglected their voluntary duties as proof readers, or it may be that they had the misfortune, from the literary point of view, to have been not "brought up," but "dragged up."

I have in my file nearly 200 letters and press notices regarding the "atrocity," including letters from some people of high standing in the literary, dramatic, journalistic, engineering, and commercial worlds, and it is strange that your reviewer was, so to speak, the "Columbus" who could fill

pages of the Electrical Review with examples of my incoherencies.

It is hard, after the burning of so much "midnight electric light" (at 8d. a unit), and paying washing bills for so many yards of "wet towelling," that my most ambitious effort should have been put on the "Index Expurgatorius." I am not quite alone, as the reviewer of your contemporary, *Engineering*, seems to be in the same dismal literary abyss as myself, as he said some months ago that "the pamphlet would deserve to be printed in full," and "which it is greatly to be hoped will reach a wide circulation."

It is a not unknown expedient of a critic or reviewer, who finds it difficult to make a frontal attack on the statements or arguments of a writer, to criticise the phraseology, the style of the work dealt with, and even the printing, binding and paper; besides, for such treatment only a limited knowledge of the subject in question is required.

If Nature had endowed me with the modern spirit of enterprise I would put a coupon at the end of each copy of the "atrocity" and would offer a prize for the "literary gent" who discovered the most "howlers," though it is probable that even the redoubtable "Captain Coe de Cocoa" would have little difficulty in "spotting the winner."

Your reviewer has, to a material extent, correctly diagnosed my political and social "creed," which I think I can say, has not changed with the weathercock of financial or political expediency. If I was sufficiently adept with my pen and on the platform, with the mixture of soap suds, puffs, hush-ups, and false suggestions so fashionable among "coming men" (photo inset), I might aspire to something almost beyond the dreams of the "Dagos," &c., mentioned by your reviewer, and even outside the range of directors of successful electrical concerns, that is to say, to be put by some great man on the "Honours Free List," which list I judge from the *Morning Post* has for some time been "entirely suspended."

With regard to the "Super-howler" quoted, I have shown it to several people, and so far I have not had to call in the ambulance, and with regard to the significance of the "Woolsack," perhaps your reviewer could obtain the information he wants from our "galloping" Lord Chancellor, or even from some school history book.

Having now been found guilty of a "literary atrocity," and having proved my respectability on more than one occasion by saying "Hang Lenin and Trotsky," the only punishment which could fit such a crime would be a Government concession over the water-power at the North Pole, assisted financially by the "nobility and gentry" of Limehouse and Whitechapel.

In sackcloth and ashes, in fear and trembling,

Theodore Rich.

London, *September 18th*, 1922.

The Kilburn Scott Nitrogen Furnace.

When the final report of the Nitrogen Products Committee was published I was in the United States, and only since returning have I been able to investigate a paragraph which appeared on p. 241 in reference to my three-arc furnace for nitrogen fixation. After giving a description of the various features of the furnace, the last two paragraphs read:—

"As the result of trials with a small experimental furnace, it is considered commercially feasible to obtain yields about 50 per cent. higher than the usual yield of 50 to 60 gms. of HNO_3 per kW-hour obtained with standard types of single-phase furnaces (*Journal* of the Society of Chemical Industry, 1915, Vol. 34, No. 3, and 1917, Vol. 36, No. 14).

"According to the information available to the sub-committee, the results of recent trials carried out with a three-phase furnace of about 300 kW capacity have not fulfilled the expectations based upon the working of the small-scale experiments."

There is no doubt that the 300-kW furnace referred to is the one installed at Messrs. Kynochs's work, at Birmingham, in 1917, because it happens to be the only one I have designed of that size. It was carefully tested by Mr. H. Robinson, and I found that as soon as he knew of the above-mentioned adverse paragraph he wrote to the secretary of the Nitrogen Products Committee as follows:—

80, Aldridge Road, Birmingham,
January 28th, 1920.

R. T. G. French, Esq., O.B.E., B.A.,
Secretary to the Nitrogen Products Committee, London.

Sir,—On page 241 of the Final Report of the Nitrogen Products Committee, in the last paragraph referring to the Kilburn Scott furnace, it is stated that information available to the sub-committee on the performance of a 300-kW furnace did not bear out its claims of a yield of 50 per cent. above the usual 50 to 60 grammes per kWh.

I would like this statement to be corrected as far as possible to any parties interested in the matter.

The 300-kW furnace was at the works of Messrs. Kynochs, Ltd., Birmingham, and I was responsible for the building and erection of the nitrogen plant and subsequent research on the nitrogen question.

I had two long interviews with Dr. Harker, of your committee, who gave me helpful information and received from me information as to the working of the furnace as far as it had gone.

Later I carried out considerable modifications in the design of details which improved it in yield and reliability.

My estimates were based on the readings of an electricity meter which was found to be reading 100 per cent. high, and this information was not obtained until February, and confirmed in March, 1919.

The final results of this furnace proved the Kilburn Scott claim of 50 per cent. higher yield to be quite sound, and I, personally, have no doubt that this type of furnace will give more than 90 grammes per kWh. My confidence is based on the fact that I have obtained on several occasions over 100 grammes per kWh with an input of 120 kW, which, owing to limitations on the plant, was the average power available during the research.

I shall be pleased to give any further information which may be desired.

Yours respectfully,
(Signed) H. Robinson.

He also wrote in much the same terms to the editor of *The Times*, but it appears that his letter was not published.

In June last I wrote to Mr. R. T. C. French, saying that owing to being away in the States, I had recently seen a copy of the above and asking if anything could be done officially to correct the impression given by the paragraph in question. In the letter I said:—

When the real tests were made, the readings of energy were read on an accurately calibrated Chamberlain & Hookham meter installed in the power house and by observers who were quite independent of the tests, being made at the nitrate plant. This meter in the power house recorded all energy going to the furnace, its choke coils and pilot sparking device, and energy for auxiliary operations in the nitrate plant, and it should be noted that the energy of these accessories was relatively large, compared with the input of the furnace.

In addition, the meter recorded the losses in the step-up transformers and in half-mile of cable between the power house and the nitrate plant, and this cable, &c., limited the input to the furnace to about 120 kW. Even with these losses added in, yields over 100 grammes were obtained, whereas I only claimed 50 per cent. increase on 50 to 60 grammes.

I afterwards saw Mr. French, and he said that when the report was published the Nitrogen Products Committee was disbanded and correspondence arising out of the report was merely filed away.

Mr. H. Robinson has written me the following further explanation regarding the incorrect meter reading:—

The power records could be obtained at two points: one on the low-tension side of the system at Witton, which thus included the losses in transformer, transmission line and choke coils, and the other at Holford on the high-tension board, which for some reason never ascertained, read over 100 per cent. higher than the low-tension board. As the high-tension board readings were always available at a moment's notice and the readings from Witton were sometimes delivered a few days after registering, we used the Holford readings for comparison in our experimental work in building up efficiency in the furnace and towers.

It was not until the beginning of 1919 that this matter was taken up, when standard instruments were installed to check the low-tension board at Witton, and a series of tests made with independent observers taking readings with the standard instrument and the low-tension board instrument simultaneously with the Holford readings. These observations established the fact that the Holford meter read 2.02 times higher than the Witton end.

Checking some of our past experience with this factor, we found we had obtained over 100 grammes per kilowatt-hour on several occasions. One eight-hours' run for absorption experiments gave an average of 83 grammes per kilowatt-hour. We also had a satisfactory run at 93 grammes per kWh, and at least two test records of 106 grammes per kWh appeared amongst the records.

I may mention that even when the furnace was worked without the preheater or the cooling boiler in operation, the average of a 7-hours' run was 83 grammes per kW-hour, and for this the kW reading included the losses in the step-up transformer and in half-a-mile of cable from power house to nitrate plant. With these allowed for, the yield would be at least 10 per cent. higher.

E. Kilburn Scott.

London, *September 5th*, 1922.

Weldrics, Ltd., v. Quasi-Arc Co., Ltd.

Our attention has been called to a paragraph in your issue of 8th instant relating to an action brought by Weldrics, Ltd., against our clients, the Quasi-Arc Co., Ltd., which action was dismissed with costs against the plaintiffs.

We have to inform you that the statement appearing in your journal that the judge showed by the correspondence which was put in evidence that the Quasi-Arc Co. limited their claim to the use of blue asbestos in the form of yarn is incorrect and calculated to cause considerable damage to our clients.

We have, therefore, to request you to be good enough to insert this letter in your next issue.

Downer & Johnson.

London, *September 18th*, 1922.

The Sandblom Electric Hammer.—Some of the advantages possessed by the Sandblom electric scaling hammer over the hand and pneumatic hammers in the removal of scale and rust from ships' sides were demonstrated at Messrs. R. and W. Hawthorn, Leslie & Co.'s dry dock at Hebburn on September 9th. Mr. E. M. Andrews, secretary of Electric Scaling Hammers, Ltd., of London, conducted the demonstration. By arrangement with Messrs. Alfred Holt, who were represented by Mr. Turnbull, a square yard of rust-encrusted plate on the bottom of the s.s. *Lycaon* was marked out and was tackled by the electric hammer in the hands of an experienced operator. Within 7½ minutes this portion of the plate was perfectly and smoothly cleaned of rust without the slightest harm being done to the plate. A hand hammer would have taken about an hour to do the work. A square yard of plate was then cleaned with a pneumatic hammer, but this method took about 15 minutes. Mr. Andrews directed attention to a lighter type of hammer specially adaptable to boiler cleaning, with which, it is claimed, a boiler can be thoroughly cleaned in a third of the time, and therefore much more cheaply than with the hand hammer.—*Newcastle Daily Journal.*

AN ELECTRIC BAKING OVEN.

The Automatic Reel Type.

For many years past electrical methods have been finding their way into the bakery and confectionery trades in spite of the high charges which it is the custom of electricity supply authorities to make for electric power and heating. The fact that electrical methods have been introduced in spite of this handicap is due to the high-grade product, which can be consistently secured by these means, and so give invariable satisfaction to the customer. In view of the fact that nearly all baking operations in large establishments are carried out at night, the electric baking load would seem to be an ideal one from the electricity suppliers' point of view. It should be one means of assisting in the continual struggle to fill up the valleys in the load curve, and in consideration of its aid in that direction such a demand should be encouraged by charging specially favourable rates for electricity.

There are many designs of baking oven at present in use, and all have in view the consistent production of articles of the highest grade, but great as the improvement has been in methods of handling and preparing the raw food products, and in the constructional design of the oven equipment, none have as yet achieved the perfection of the electrically-heated commercial baking oven. With this oven the results are uniform and the food is more thoroughly cooked.

The heat can be confined to the oven in a manner which is impossible except with electricity as the source of heat, and this leads to greatly improved sanitary conditions in the bakehouse.

The popularity of the electric range for domestic purposes is now thoroughly established, and when designing a similar equipment for the bakery trade electrical engineers have

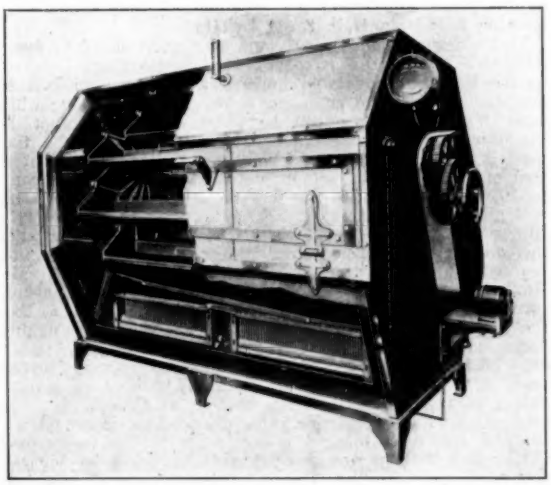


Fig. 1.—Electric Oven, showing Shelves and Heating Elements.

spared no time or expense in experimental work, with the result that appliances are now available that demand the serious consideration of those engaged in the bakery and confectionery trades.

The oven illustrated (fig. 1) is manufactured by the Westinghouse Electric & Manufacturing Co., of Pittsburgh, U.S.A., and is sold in this country by the Metropolitan-Vickers Electrical Co., Ltd. The automatic electric bake oven is built entirely with *heat-insulated panels*. The outer covering of the panel is of heavy gauge galvanised iron; the inner covering is of non-corrodible steel. Outside the galvanised panels are placed sheets of steel finished in three coats of white vitreous enamel baked at 1,700 deg. F., which are held in place by nickel-plated straps and angle iron, thus giving a clean finish to the whole apparatus. The high temperature at which the enamel is baked on ensures that it shall be unaffected by subsequent use of the oven.

Inside the baking chamber is a revolving reel, which supports eight shelves, each 11 in. wide by 71 in. long, perforated to allow free circulation of the heated air between the baking tins. The rubbing parts are made of a special lubricating metal consisting of bronze graphite, and the reel is driven by means of an electric motor through a train of gears; special attention has been paid to the elimination of noise and of friction. The gears are entirely enclosed, and the motor is started and stopped by means of a snap switch; the oven door can be opened and closed with one hand, it is thoroughly heat insulated, and is balanced by means of counterweights fitted inside the oven. The open door forms a shelf at just the right height for use in loading and unloading the oven. The oven is simple and automatic in operation. To indicate the temperature a thermometer with a hand-set indicator is fixed in such a position as to indicate the true temperature of operation, which is controlled by a thermostat, the pointer of which can be set at any temperature required. All that is needed is to set the thermostat pointer and to push a switch button marked "on," and when the baking temperature is reached, the temperature-control equipment operated by the thermostat maintains it continuously and entirely automatically at the point at which the thermostat pointer has been set. When the oven has been loaded and the door closed the reel need only be kept revolving during the baking period; the temperature being maintained constant and the conditions the same, every batch can be made to turn out perfectly, evenly raised, uniformly and richly browned, and thoroughly baked. Actual results obtained by practical bakers show that the automatic reel electric oven is economical in use. It has been shown that the amount of flour required to turn out a specified number of loaves was actually less than with ovens previously installed, and the saving represented by the additional loaves was more than sufficient to pay for the electricity used. Further, the electric oven is constructed to retain the steam driven out of the loaves, so it is unnecessary to inject live steam into the oven, and the use of a steam boiler can thus be avoided. Practical bakers will recognise this as a matter of no little importance. The simplicity of operation necessarily reduces the labour cost—another economy of considerable moment, and the cleanliness and absence of external heat mean healthier conditions in the bakehouse, and they, in turn, affect the quality of the product.

A demonstration model of this newest of electric baking ovens is being erected in one of the most up-to-date bakeries in this country, and considering the advantages set out above the general use of electric bread-baking ovens automatically controlled should not be long delayed.

THE ELECTRICAL SITUATION IN RUSSIA.

According to a Moscow correspondent of a Russian newspaper published in Berlin, many years will be occupied merely with the preparatory works in connection with the proposed electrification of Russia. Apart from this statement, the Russian newspapers themselves show that but little progress is being made, particularly owing to the scarcity of money.

The Council of the National Commissioners a little time ago granted a credit of 6,500,000 gold roubles to the State Electrical Bureau, and of this sum only 12½ per cent. had been paid over by August 1st, 1922. As a consequence the constructional programme has been further curtailed. It has also been necessary to leave in abeyance the schemes for improving the central stations at Petrograd and Moscow, and in other large centres, while there is naturally no question of supply being rendered available for villages, as conceived in the original programme.

A fresh examination of the problem is reported to have been made by the State Electrification Commission, which recently issued a report on the question in which were enumerated the works carried out in recent years.

Among the latter the report mentions the following: (1) The Schaturskaja works, which is 80 miles distant from Moscow and is situated on a large peat moor in the district of Rjasan. It is capable of being extended to 100,000 kW in the future. (2) The Kaschirskaja steam power generating station on the river Oka, about 68 miles from Moscow. The plant installed comprises two turbo-generators, each of 6,000 kW, and the supply of current is to begin this year; extensions to 60,000 kW are possible. (3) The Bogorodsk peat fuel station of 20,000 kW. Mention is also made of the Moscow works, which is very old and defective, and is equipped with nine turbo-generators of a total of 51,000 kW, which will soon have to be replaced by new machines. Since 1919 the boiler furnaces have been fired with wood in place of naphtha, but the wood supply is also very defective.

The peat power station of Utkina Saïvodj, on the Neva, which is to supply Petrograd, is a new works, which has probably now been set in operation. It is equipped provisionally with plant of 10,000 kW. Besides this there is a steam-power station of 6,000 kW in the Ural, and a large number of small stations, representing a total of 20,000 kW, were brought into use between 1917 and 1921, the plant having been mostly transferred from idle factories and supply works.

As compared with this situation of affairs it is mentioned that there were about 6,000 electricity works in Russia in 1916 of a capacity of from 1,800,000 h.p. to 1,900,000 h.p., and producing about 5,000,000,000 kWh per annum.

Coming to consider the question of manufacturing, the report states that the native works in pre-war times only produced small generators. Thus in 1913, for instance, the output was 14,000 dynamos and motors of a total of 311,000 kW, but the production has enormously declined in recent years,

while the imports have practically ceased excepting certain turbo-generators, which were imported in 1916-1917.

It will be necessary in future for a long time forward to procure from abroad the plant and machinery required in connection with the preliminary works of electrification. The first section of the general scheme comprises the erection of 20 steam-power stations of a total of 1,100,000 kW and 10 hydro-electric works of 640,000 kW. It is calculated that these works will require the provision of 6,000,000 barrels of cement, 150,000,000 bricks, 131,000 tons of iron and steel, 41,000 tons of copper (in machines), 2,000,000 insulators, turbo-generators of 1,100,000 kW, boilers of 470,000 square metres heating surface, and hydraulic turbines with generators for 640,000 kW. The hope is entertained in Russia that American and German firms will assist in the execution of the scheme—by the grant of long credits—in the supply of machinery and plant.

On the latter point it was recently reported that the Siemens-Schuckert works had granted credits to the Russian State Electricity Trust in the form of deliveries of machinery. This statement has now been contradicted in Berlin, where it is mentioned that in the case of former small orders placed by the Russian Government the Berlin firms always demanded payment in advance.

THE SHEFFIELD ELECTRICITY SUPPLY UNDERTAKING.

Annual Report, 1921-22.

The Sheffield Corporation electricity supply undertaking (engineer: Mr. S. E. Fedden), which is third in point of size in the United Kingdom, has again had a successful year, although the net profit was reduced to an enormous extent. Having regard to the vicissitudes through which the city and its staple industries have passed, this is not to be wondered at—indeed, the result may be considered very satisfactory.

The revenue for the year ended March 31st last amounted to £753,148, as compared with £982,546 in the previous year, a decrease of £229,398. The working expenditure did not fall in the same proportion being £450,089, as against £618,005, a decline of £167,916. The bulk of the decrease in revenue was due to the falling off in power consumption, although the lighting and heating income was also smaller, due apparently to reductions in price. The principal decrease in working costs was, of course, due to the smaller coal consumption, the cost of coal (including ash-handling) falling from £402,050 to £246,507. Management and distribution costs showed a small increase, but the costs of repairs and maintenance were lower at £40,399.

The gross profit of £303,059, compared with £364,541 in 1920-21—a decrease of £61,482. Interest and sinking fund payments were higher than in the previous year, absorbing £260,887, as against £232,234, and the net result was a profit of £11,225, which was £95,469 less than the net profit shown in 1920-21.

The installation and motor revenue account showed an income of £43,308 (£99,479), and an expenditure of £20,288 (£22,535), leaving a gross profit of £3,715 (£12,077). Capital charges reduced this balance to £599 (£9,636).

The two balances transferred to the appropriation account, together with an amount of £39,098 from the reserve fund, made a total of £50,922. This was distributed as follows:—Interest on reserve fund investment, £922; rate relief, £30,000; and to renewals and special expenditure fund, £20,000. This last fund now has a balance of £89,813; other balances are:—Reserve fund, £45,766, motor and cooker hire fund, £2,209; sinking fund, £89,051; and stock extinction fund, £260,108.

The expenditure on capital account during the year totalled £234,966; this included £112,119 for mains, £49,294 on equipments and transformers, and £36,469 on machinery and plant for the Blackburn Meadows station.

The total number of kWh sold was 103,170,062, a decline of 38,191,639 or 37 per cent. This decrease was practically accounted for by the smaller sales of energy for power purposes, *viz.*, 67,407,652, as against 100,978,107 kWh. The average price obtained per kWh was 1.74d., as against 1.65d., there being an increase in the price obtained for power, and a decrease in lighting and heating revenue.

The plant capacity now stands at 93,000 kW, and the total connections at the end of the year were equivalent to 203,082 kW. The number of staff and workpeople employed is 874, and last year wages and salaries amounted to £186,666.

Cast Iron Research Association.—We have received from the British Cast Iron Research Association, Central House, New Street, Birmingham, a short report upon work carried out for members (Booklet 3). This is a concise review of the way in which a large number of queries are dealt with. The questions cover a wide range, and deal with production of cast iron, treatment, and moulding.

REVIEWS.

Boiler Plant Testing. By David Brownlie, B.Sc. Pp.10+168; illustrated. London: Chapman & Hall, Ltd. Price 10s. 6d. net.

In presenting this book the author has endeavoured to make out a strong case for a standard international code of boiler-plant testing, and as plainly indicated in his choice of a sub-title, the work is intended as a criticism of the present boiler-testing codes, with suggestions for an improved code which could be adopted internationally.

The work is divided into four parts: the first deals with the results at present being obtained on boiler plants in general, the second is a frank criticism of existing codes, with suggestions for improvement, while the third section is mainly suggestions for new features that may be added in the future to an international code, the author concluding with a fourth part on the design of a new and improved code as a suggested basis for the international code. The Report of the Institution of Civil Engineers' Committee, or the "Civils" code, to use a more homely phrase, comes in for some very severe criticism throughout the book, and in fact one rather wonders whether the author has left even a single paragraph intact, or indeed whether it would not be better to collect the shattered fragments of the code after the author's destructive attack and consign them to the furnace as far as their value for practical testing is concerned. The American Society of Mechanical Engineers code, too, does not escape unscathed, although the author is a member of the society, and obviously considers that its Power Test Committee's findings are more up-to-date and generally superior on the whole to the "Civils'" code.

The first part of the book, which is devoted to a study of the results at present being obtained on boiler plants in general, is most interesting, being based upon the results of the author's investigations on some 400 different plants, representing over 1,500 boilers at work in no less than 41 different industries. The true average net working efficiency of the whole of these 400 plants is only 58 per cent., and the figures given appear to be thoroughly representative of ordinary boiler plants in Great Britain.

This efficiency figure may come as a rude shock to many engineers, but there is no doubt whatever that one is accustomed to see exaggerated boiler-test figures published in engineering literature supposed to be above suspicion; while such "stunt" figures can be obtained, they cannot be maintained in everyday practice. The quality of the fuel used is of great importance, and the author shows that if coal of 12,000 B.th.u. per lb. deteriorates, say 10 per cent. to 10,800 B.th.u., then the loss of evaporation in practice will probably be some 15 to 17½ per cent., and conversely a 10 per cent. increase above 12,000 B.th.u. will give a similar increase in evaporation above 10 per cent. In the section devoted to proposals for a future international code Mr. Brownlie proposes the use of a standard curve of efficiency correction for the diminishing heat value of the fuel, so that the correction figure would increase as the fuel quality decreased. The necessary data would have to be obtained experimentally for typical coals, and as regards British coals, perhaps this matter could form the basis of an investigation at H.M. Fuel Research Station at Greenwich. In connection with the calorific value of fuels, the usual phraseology of coal of so many "B.th.u.'s per lb." is freely used in the text without any distinct qualification as to whether the gross, net, or other specific calorific value is intended. This is a very usual custom, perhaps, but in view of the fact that even experts cannot agree as to standard expressions of calorific value, it seems very necessary to state which particular basis is intended when quoting the heating value of any fuel.

The author apparently uses a Mahler-Donkin bomb calorimeter, and tests the damp coal as fired, thus obtaining the gross calorific value, which includes the latent heat of the steam in the bomb. This value has apparently been used in working out all the tests in order to prevent confusion and simplify results. Regarding the percentage of ash obtained from the boilers when checking results, one cannot be certain that the percentage will always in practice be higher than the absolute non-combustible matter as obtained in the laboratory, although, theoretically, it is, of course, impossible to ensure complete combustion. Figures of 1 to 2 per cent. of combustible matter in the ash are not so easily obtained in general practice, and 5 per cent. is unfortunately not so uncommon as might be supposed. But the correct sampling of the ash and clinker after a trial is a difficult matter unless the whole of the non-combustibles are thoroughly crushed and mixed, although the author does not mention this point, or the fact that with some coals an appreciable quantity of dust and gritty matter is carried away with the furnace gases, and cannot appear as ash in the ash pits.

An interesting coal balance sheet is given for Great Britain, from which one gathers that we consume approximately 90 million tons of coal annually for steam generation alone, or about 48 per cent. of our home consumption. To show the necessity of better boiler management, Mr. Brownlie estimates that only 6½ million tons are being burnt

at 70 per cent. efficiency or over, 13 million tons at from 65 to 70 per cent. efficiency, 15¼ million tons at 60 to 65 per cent. efficiency, 21¼ million tons at 55 to 60 per cent., 18 million at 50 to 55 per cent., and 15¼ million tons at less than 50 per cent. efficiency. These figures are lamentable when one considers that modern boilers and economisers can be operated at a figure of about 75 per cent. efficiency under modern conditions with proper supervision and appliances.

In the second portion of the book we are treated to a very healthy criticism, both destructive and constructive, of existing boiler-testing codes. The idea that boiler testing is a complicated and difficult operation, involving a superior knowledge of chemistry and mathematics, must arise in the mind of the engineer after a study of the "Civils" code. and the author makes it plain that on these grounds alone he is not in sympathy with the code. Boiler-plant testing ought to be regarded as a thoroughly practical proposition, which is necessary to secure economy and save money.

After discussing various sections of the codes the important question of the sampling and analysis of the fuel is considered at some length, as naturally so much depends upon accuracy in this matter. Sampling is, after all, largely a matter of common sense, and the suggestion is made that two separate samples should always be taken and the results worked out on the average of the analyses. The "Civils" code decides that the efficiency calculations shall be worked out on the lower or net heating value of the fuel; whilst the American "Mechanicals" code takes the simple or gross value of the dried coal as determined in an oxygen bomb calorimeter. The Barrus calorimeter given in the list of apparatus required in the "Civils" code is not, of course, a fuel calorimeter, as is supposed by the author, and the code does not recommend any specific make of calorimeter, although it states that a compressed oxygen bomb type should be used. The question of gross and net calorific values is fully discussed, and Mr. Brownlie considers that the chief objection to the method of using the calculated net or lower heating value is the necessity of carrying out a complicated and troublesome chemical analysis of the fuel in order to determine the percentage of hydrogen contained. Boiler-plant testing is, after all, a practical business for engineers, and the suggestion of abandoning the calculated net or lower calorific value in the proposed international code would certainly simplify matters, as is done in the existing American code. The method of taking the gross heating value determined in the oxygen bomb calorimeter on the dried fuel and then correcting for the moisture contained in the coal, is a much simpler proposition in practice, and has much to recommend it, although, if the correction for evaporation loss is included, it is necessary to fix the upper and lower temperature limits for the furnace conditions. Strangely enough, the author does not actually criticise the "Civils" formula for the calculation of the net value, nor does he even quote the paragraphs in Appendix II of the Code wherein the exact methods of calculation are laid down on the assumption that the water condensed in the bomb is cooled to 60 deg. F., and that the moisture and hydrogen have been properly determined. The "Civils" method is essentially academic, and is only correct for certain specific conditions, and one cannot but feel that the extra trouble and complications involved are not worth while in the practical testing of boiler plant, whilst the difference in the calculated efficiency is only of the order of 3 per cent.

With regard to methods of flue gas analysis, both Codes are considered to be out of date, as they favour the use of hand apparatus such as the Orsat, and disparage combustion recorders. The author's experiences with CO_2 recorders appear to have been very happy indeed over a period of twelve years or so, although the names of the particular instruments are not given in the text. Later the author states that only within the last few months has a continuous gas analysing machine for CO_2 and CO been perfected in Stockholm and placed upon the American and British markets under the name of the "Duplex Mons" automatic gas analysing machine.

Methods of measuring the boiler feed water are considered in detail, and the question of the determination of the moisture in the steam is discussed. This latter determination is important where superheaters are not in use, and the author criticises the methods of steam calorimetry recommended in both of the Codes, and suggests that owing to the difficulties of obtaining accurate results, the determination of moisture should be abandoned in the International Code. With regard to the specific heat of superheated steam, it is suggested that Knoblauch and Jakob's figures should become the standard, and no mention whatever is made of Callendar's data on the subject. The question of steam tables for the proposed International Code has not been dealt with, although, of course, there is not a great deal of difference on the whole between such authorities as Callendar, Marks and Davis, and Smith and Warren, yet it would seem desirable to secure unification on this matter in an International Testing Code. In working out the evaporation of the boiler, the usual figures of actual water per lb. of coal and water "from and at 212 deg. F." are given in both Codes, but Mr. Brownlie suggests that in the International Code a new figure of "lbs. of water from and at 212 deg. F. per 1,000,000 B.th.u." should be included in order to obviate the error due to the varying heating values of different fuels. Both Codes are considered to be unnecessarily complicated in the methods used in working out the results of the trials, the usual heat balance being both unnecessary and inaccurate in practical boiler-plant testing in the author's opinion. More modern methods of calculating the results are given in the text, and they are certainly fairly simple.

The author's treatment of the subject throughout is very sound, and his criticisms of the existing Codes should appeal to engineers who have had much to do in connection with power plant tests. There are one or two obvious errors in the text, but on the whole the book is lucidly written and well illustrated, and it should prove valuable to boiler-house superintendents and power-plant engineers generally.

L. M. J.

Elementary Determinants for Electrical Engineers. By Herbert P. Few. Pp. 98; figs. 32. London: S. Rentell and Co., Ltd. Price 4s. net.

Many electrical problems reduce to a set of simple simultaneous equations, and it is then always possible to arrive at the solution by any of the usual methods for eliminating all but one of the unknown quantities, but frequently such methods call for a considerable amount of algebraic manipulation and arithmetical computation, so that the process becomes lengthy and laborious. But if the terms of the set of equations be arranged in a certain order, it is possible to derive mechanical rules by the aid of which all the unknown quantities may be evaluated. By using these rules all the algebraic operations on the original equations necessary to secure solution are avoided, and only the arithmetic peculiar to the problem remains. To evolve and understand this mechanical rule it is necessary to discuss the relationships that exist between the coefficients of a set of simultaneous equations, for which purpose a special concise form of notation is adopted; this section of mathematics is known as determinants, and is perhaps not sufficiently well known by those who would regard mathematics as a tool for practical use, for in many books on practical mathematics it receives no mention. While it may be admitted that determinants are not essential in everyday practical calculations, yet they may be exceedingly useful as a labour-saving device when certain types of problem are frequently met with. It is with the object of emphasising the advantages of the determinant method in certain problems of direct interest to electrical engineers that this little monograph on the subject has been written.

The scope of the book is practically limited to the solution of simple simultaneous equations, the matter being very clearly and logically arranged and profusely illustrated with practical electrical examples.

Starting with a statement of the advantages of the use of determinants, the ordinary method of solving two or three simple simultaneous equations is explained and illustrated by simple examples involving Kirchhoff's laws. The determinant notation, the rule of Sarrus, and the mechanical rule for evaluating the unknowns in three simultaneous equations are then explained. The application of the method to simple practical examples is assisted by the use of Clerk-Maxwell's rule for current values in networks. Some of the important principles and properties of the determinant notation are then discussed, leading up to the evaluation, in a routine manner, of determinants of any order.

The remainder (about one-half) of the book is devoted to the practical application of the determinant method in solving problems on Wheatstone networks as employed in measurement and testing, on telegraph and telephone circuits, power networks, magnetically-coupled circuits in radio work, and in various interesting academic problems on resistances of networks.

The book is well produced, clearly written, and is interesting, and should be very useful to those who are continually meeting with problems such as are treated therein. Each chapter is followed by a number of examples to be worked, and to which answers are given.

One criticism may be made, viz., many of the worked and set examples involve considerably more knowledge than that which, judging from the preface, the reader is expected to possess. It is stated in the preface that "no knowledge of algebra beyond that involved in the solution of simple equations is required of the reader," yet in the second half of the book will be found mention of trigonometrical expressions, logarithms, factorial notation, exponentials, imaginary quantities, calculus notation, and a differential equation of the second order. In view of the advanced and specialist nature of some of the problems discussed, a reader whose mathematical equipment is limited to simple equations is hardly likely to be interested in such problems. The foregoing quotation is true as regards the bare determinant principles treated in the book, but is certainly not applicable to a large proportion of the practical examples; it is an unfortunate sentence, and would be better omitted.

The modern symbol for $\sqrt{-1}$ is j; the use of the older symbol i is particularly inadvisable in a book whose main theme is the solution of electrical problems in which i is constantly being used to denote current.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

23,772. "Signalling systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). September 1st.
23,785. "Radio receiving apparatus." H. T. Inston and S. Peplow. September 1st.
23,793. "Electric switch actuating mechanism." H. P. McColl. September 1st. (Australia, September 29th, 1921.)
23,815. "Junction boxes for electric cables." W. Lawrence and Mavor and Coulson, Ltd. September 2nd.
23,822. "Electrical transmitters." B. A. Pilkington. September 2nd.
23,823. "Electric switchboards." P. J. Gates. September 2nd.
23,824. "Electric batteries." F. A. Freeth and L. A. Munro. September 2nd.
23,832. "Brush holders for dynamo-electric machines." W. F. Grafton. September 2nd.
23,845. "Reception of wireless signals." W. Bannister. September 2nd.
23,847. "Sparking plug for internal-combustion engines." A. H. Price. September 2nd.
23,857. "Time switches, &c." Landis & Gyr Akt. Ges. September 2nd. (Switzerland, September 3rd, 1921.)
23,866. "Manufacture of sparking plugs." H. G. Longford and Sphinx Manufacturing Co., Ltd. September 2nd.
23,874. "Electric switches." J. Anderson. September 2nd.
23,883. "Resistances for wireless telegraphy." F. Harrison. September 4th.
23,910. "Electric lamp holder." M. Endeau. September 4th.
23,928. "Electrical transformers." Metropolitan-Vickers Electrical Co., Ltd., and A. E. L. Scanes. September 4th.
23,929. "Means for testing ignition and sparking plugs for internal-combustion engines." J. W. T. Cadett. September 4th.
23,931. "Recuperable electrolytic cell." C. F. Buffard. September 4th. (France, September 15th, 1921.)
23,941. "Method of signalling over telephone conductors." Siemens and Halske Akt. Ges. September 4th. (Germany, September 5th, 1921.)
23,970. "Controlling devices for dynamo-electric machinery, &c." J. H. Whittaker Swinton. September 4th.
23,977. "Electrolytic gas generating systems." J. P. Scott. September 4th.
23,990. "Elements for electric heat appliances." F. Sanders. September 4th.
24,001. "Resistances for wireless apparatus." G. Shaw. September 5th.
24,006. "Electric conductors for alternating current." T. F. Wall. September 5th.
24,016. "Device for indicating temperature of windings, &c., of electric machines." E. Schroder. September 5th.
24,017. "Device for indicating temperature of windings, &c., of electric machines." E. Schroder. September 5th.
24,030. "Control of prime movers." A. H. Railing. September 5th.
24,029. "Crystal detectors." R. L. Murray. September 5th.
24,038. "Electric machines." W. C. Lindemann. September 5th.
24,051. "Flexible torque couplings and electric locomotives employing same." H. G. Dempster. September 5th.
24,052. "Magneto brush and force feed attachments for internal-combustion engines." W. Martin. September 5th.
24,061. "Electric switches." F. Handley and O. Lucas. September 5th.
24,063. "Spacking plugs." J. Kurcharek. September 5th.
24,065. "Polyphase meters." New Antwerp Telephone and Electrical Works. September 5th. (Belgium, September 8th, 1921.)
24,079. "Electric radiators." G. H. Collins and H. F. Collins. September 6th.
24,086. "Inductance coils for wireless receiving apparatus." S. H. V. Abbott and E. W. Scammell. September 6th.
24,087. "Magnetic separators." S. B. Morgan. September 6th.
24,094. "Electric foot and food warmers." T. Shepherd. September 6th.
24,103. "Hydraulic telemotor system." J. Patterson. September 6th.
24,116. "Telephones." A. T. Collier. September 6th.
24,122. "Receiving apparatus for wireless signalling." H. P. P. Rees. September 6th.
24,135. "Rectifying devices." A. R. Angus. September 6th.
24,149. "Steam turbines." Metropolitan-Vickers Electrical Co., Ltd. September 6th.
24,150. Electric power shovels." Metropolitan-Vickers Electrical Co., Ltd. September 6th. (United States, September 12th, 1921.)
24,165. "Electricity meters." Chamberlain & Hookham, Ltd., and S. James. September 6th.
24,170. "Emergency device for escalators, &c." Otis Elevator Co, and Waygood Otis, Ltd. September 6th.
24,171. "Emergency device for escalators, &c." Otis Elevator Co. and Waygood Otis, Ltd. September 6th.
24,180. "Electrically-propelled invalid carriages, &c." J. & A. Carters, Ltd., and L. W. G. Payne. September 6th.
24,186. "Electron discharge devices." J. Gray. September 6th.
24,187. "System of wireless transmission and reception of energy." H. Kirschfeldt. September 6th.
24,189. "Aerials for reception of wireless waves." B. E. Major. September 6th.
24,196. "Hand irons." Electric Heating and Hardware, Ltd., and F. J. Wineberg. September 7th.
24,220. "Means for utilising tides, &c., for producing electricity, &c." T. M. Adair. September 7th.
24,228. "Control of prime movers." A. H. Railing. September 7th.
24,229. "Electrically-lighted sewing machine." W. Fairweather (Singer Manufacturing Co.). September 7th.
24,233. "Electrically-operated signalling apparatus for ships' telegraphs." J. W. Ray. September 7th.
24,273. "Time switches." Landis & Gyr Akt. Ges. September 7th. (Switzerland, September 7th, 1921.)
24,274. "Galvanic batteries." J. Oldham and Oldham & Son, Ltd. September 7th.
24,275. "Electron discharge apparatus." British Thomson-Houston Co., Ltd. September 7th. (United States, September 8th, 1921.)
24,276. "Electron discharge apparatus." British Thomson-Houston Co., Ltd. September 7th. (United States, September 8th, 1921.)
24,277. "Radiation measuring devices." British Thomson-Houston Co., Ltd. September 7th. (United States, December 31st, 1921.)
24,280. "Boxes for electric lamps." A. H. Stevenson and H. G. Thompson. September 7th.
24,285. "High-frequency apparatus for reception of wireless signals and telephony." A. E. Mitchell. September 7th.
24,294. "Dry batteries." M. I. David and E. E. Dutt. September 7th.
24,297. "Burglar alarms." G. B. Carpenter. September 7th.
24,298. "Asynchronous induction motors." T. Torda. September 7th. (Hungary, November 22nd, 1921.)
24,312. "Sparking plugs." G. B. Sykes. September 7th.
24,341. "Connexion means of electric accessories, &c." Electric Heating and Hardware, Ltd., and F. J. Wineberg. September 8th.
24,346. "Electrically-heated casting irons and tongs for pianoforte construction." T. G. Henry. September 8th.
24,383. "Controlling device for illuminating electric signs, &c." C. L. Morris. September 8th.
24,388. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. September 8th. (United States, November 22nd, 1921.)
24,389. "Devices for testing sparking of electric sparking circuits." Edison Swan Electric Co., Ltd., and P. Freedman. September 8th.
24,392. "Systems of connections for coil conductors." Siemens and Halske Akt. Ges. September 8th. (Germany, June 15th.)
24,401. "Electric motor interrupter." Reiniger Gebbert and Schall Akt. Ges. September 8th. (Germany, January 12th.)
24,408. "Systems of connexions for coil conductors." Siemens and Halske Akt. Ges. September 8th. (Germany, June 15th.)
24,425. "Electric soldering apparatus and soldering agent for band saws, &c." R. Kapp. September 8th.
24,430. "High-tension spark indicators." J. Schwartz. September 9th.
24,471. "Electrical apparatus for high-frequency circuits." A. H. S. MacCullum. September 9th.
24,477. "Manufacture of electric incandescent lamps." Handelsvennootschap onder de Firma Vogels & Co. September 9th. (Holland, June 26th.)
24,491. "Sparking plugs." J. H. Im Thurn and N. E. Maude-Roxby. September 9th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

6,167. "Thermionic amplifiers employing resistance couplings." Dr. S. Loewe. February 23rd, 1920. (159,472.)
6,272. "Apparatus for electrically welding the flanges of metal rims of wheels." G. Giorgini. February 24th, 1921. (184,822.)
6,326. "Automatic electric cut-outs." O. Szaszovsky. February 25th, 1921. (Convention date not granted.) (159,478.)
10,935. "Three-electrode discharge bulbs or valves." Soc. Anon. Pour l'Exploitation des Procédés Maurice Leblanc Vickers. April 15th, 1920. (161,587.)
11,349. "System of pole-changing for polyphase induction motors." Dr. O. T. Blathy. April 19th, 1920. (161,973.)
11,375. "Electric battery with depolarisation by means of air." K. Warnon. April 20th, 1921. (184,841.)
11,890. "Furnaces for electric heating." A. H. Pehrson. April 26th, 1920. (162,285.)
13,521. "Relays." S. M. Day. May 12th, 1921. (184,847.)
13,572. "Wiring systems for electric light and power installations." L. J. Lepine. May 13th, 1921. (184,849.)
13,865. "Windings for electric transformers and the like." Sachsenwerk Licht-und Kraft Akt. Ges. and F. Haberle. May 25th, 1920. (163,704.)
13,952. "Wireless receiving systems." British Thomson-Houston Co., Ltd. (General Electric Co.). May 18th, 1921. (184,862.)
14,143. "Electron discharge apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). May 20th, 1921. (184,875.)
14,151. "Electric current limiting devices." W. H. Glaser and W. H. Glaser, Ltd. May 20th, 1921. (184,876.)
14,324. "Dynamo-electric machines." A. H. Midgley. May 23rd, 1921. (184,889.)
14,561. "Electric discharge devices." British Thomson-Houston Co., Ltd. (General Electric Co.). May 25th, 1921. (184,903.)
14,573. "Wireless signalling." C. S. Franklin and P. P. Eckersley. May 25th, 1921. (184,904.)
14,777. "Ignition magnetos for internal-combustion engines." British Lighting & Ignition Co., Ltd., and E. O. Turner. May 27th, 1921. (184,905.)
15,433. "Shock-absorbing supports, suitable, for example, for head-lamps." British Thomson-Houston Co., Ltd. (General Electric Co.). June 3rd, 1921. (184,917.)
15,645. "Magneto-electric machines." R. Bosch Akt. Ges. June 7th, 1920. (164,344.)
15,869. "Electromagnetic stop motions for textile machinery, such as roving or the like machines." W. Whitehead, N. Whitehead, C. Smith, and E. W. Varley. June 9th, 1921. (184,922.)
16,062. "Flow meters." British Thomson-Houston Co., Ltd. (General Electric Co.). June 10th, 1921. (184,926.)
16,243. "Electric motors." British Thomson-Houston Co., Ltd., and F. H. Clough. June 13th, 1921. (184,931.)
16,442. "Sparking plugs of internal-combustion engines." H. Lodge. June 15th, 1921. (184,934.)
16,569. "Automatic electric-circuit breakers." A. H. Railing, A. E. Angold, and H. C. Turner. June 16th, 1921. (184,935.)
16,619. "Operation of processes and cells for electrolytic decomposition of alkali salts." M. Wilderman. June 16th, 1921. (184,938.)
16,833. "Means for reducing irregularities in the voltage generated by direct-current generators." G. Sutton. June 20th, 1921. (184,941.)
16,889. "Lamp holders for electric incandescent lamps." Dr. A. H. Mollik and Merz-Werke (Geb. Merz). October 18th, 1920. (170,552.)
17,608. "Electric switch boxes." British Thomson-Houston Co., Ltd. (General Electric Co.). June 28th, 1921. (184,950.)
18,126. "Method of and apparatus for cleaning the discharge electrodes in apparatus for the electrical precipitation of suspended particles from gases." Lodge Fume Co., Ltd. (Metallbank und Metallurgische Ges.). July 4th, 1921. (184,959.)
18,311. "Sound amplifiers." A. E. Stebbing. July 6th, 1921. (184,960.)
19,354. "Electric traction." R. Brooks and Metropolitan-Vickers Electrical Co., Ltd. July 18th, 1921. (184,978.)
20,117. "Devices for locking electric lamp bulbs to their carrier sockets." C. A. Ely. July 27th, 1921. (184,982.)
21,025. "Electric switches." R. Alkan. March 24th, 1921. (Addition to 149,940.) (177,485.)
23,241. "Manufacture of storage battery electrodes." Fuller's United Electric Works, Ltd., and R. E. Beswick. September 1st. 1921. (185,023.)
23,471. "Control of electric lamps for cabinets, desks, and the like." C. J. Barnet and K. O. Davis. September 3rd, 1921. (185,026.)
24,026. "Vacuum tubes and method of making same." Western Electric Co., Ltd. (Western Electric Co., Inc.). September 9th, 1921. (185,030.)
24,782. "Sockets or bases for trolley poles for electrically-propelled vehicles." E. M. Munro. September 19th, 1921. (185,031.)
34,848. "Galvanic cell." A. Heil. December 28th, 1921. (Convention date not granted.) (173,515.)

1922.

179. "Couplings for insulators." British Thomson-Houston Co., Ltd. (General Electric Co.). January 3rd. 1922. (185,058.)
395. "Electric radiators." E. C. R. Marks (Fabbrica Apparecchi Elettrici F.E.R.T.). January 5th, 1922. (185,059.)
667. "Locking device for electric lamps." S. D. White and C. W. Saunders. January 9th, 1922. (185,060.)
2,089. "Controlling devices for the motors of electrically-driven vehicles." F. Krupp Akt. Ges. February 4th, 1921. (174,922.)
3,937. "Electric batteries." Soc. Anon. "Le Carbone." April 19th, 1921. (178,804.)
8,215. "Joints or connections of electric cables and the like." J. H. van Viersen. November 1st, 1921. (185,069.)
8,890. "Electric overload protective systems." F. Krupp Akt. Ges. May 26th, 1921. (180,636.)
13,471. "Regulating devices for electric installations." Etablissements de Dion Bouton (Soc. Anon.). June 27th, 1921. (Addition to 178,418.) (182,445.)
18,327. "Relays." S. M. Day. May 12th, 1921. (Divided application on 184,847.) (185,074.)